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ELECTRICAL WORLD AND ENGINEER.

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THANKSGIVING.

This year, not less than other recent years, the country has a great deal to be thankful for, and the religious exercises of the week may well be approached in a spirit as cheerful as devout. In the domain of electricity, the workers have in general much cause for congratulation, for while quietness and dullness may have fallen upon other industries to some extent and temporarily, electrical applications of every kind have on the whole remained in exceedingly brisk demand. This is because the trend of the times is increasingly towards the adoption of electrical principles, ideas, inventions and apparatus; and such being the case, electrical arts may often remain busy during periods of prevalent slackness. But the nation has for some years now enjoyed great and substantial prosperity, which the future will see renewed and broadened, and he must, indeed, be a poor-spirited American who does not return hearty and fervent thanks for what we have received from a bountiful Providence.

ELECTRICITY FOR TRUNK RAILROADS.

We feel sure that there is not a single reader of this journal who will take exception to the statement that in the contracts just awarded by the New York Central Railroad for the equipment of its system by electricity, is one of the most vital and epochal occurrences in electrical development of recent years. While in itself this step may probably be regarded as but one in a natural sequence running back to the very first effort to drive a car axle by adjusting a motor to it, it is an event of this kind which serves to mark the close of one era and the beginning of the next. The New York Central Railroad is one of the great trunk systems of America and of the world, and whatever action it may take of this sweeping character is destined to have not merely local effect, but to influence deeply the ideas and decisions of other leaders in the railroad field. Depending ever since its inception and up to the present time solely on steam as a means of locomotion, it has now put in force a resolve whose effects cannot cease until its very last steam locomotive has been banished from the tracks and relegated to the scrap heap.

There are a great many points of view from which this remarkable announcement of contracts may be considered. First of all, the magnitude of the order is very striking, for it includes no fewer than eight steam turbo-generator sets of 7,500 hp each, and 30 electric locomotives of 2,200 hp each, with of course the necessary and auxiliary boilers, condensers, etc., in the steam plant; and, it may be assumed, the electric lighting and electric heating of most of the passenger cars that are to be hauled. Furthermore, while the commission which has been deciding these points for the company may have started out more or less with the intention that it would carry out the law and the ordinances requiring the abolition of steam in the Park Avenue Tunnel, the members have found themselves carried onward by an influence greater than themselves, and making irresistibly for electricity, to decide that the new motive power shall be applied not merely in the tunnel, but on all the lines running out from the Grand Central Depot for at least 40 or 50 miles. Hence, it would appear that not only is the suburban traffic to be hauled in behind electric motors, but that at the edge of the electric zone the steam locomotives will be detached from the heaviest through trains and will also be brought down to the heart of the city by electric traction. This is something again which no railroad in the world has ever done before, and the New York

Central Company is to be congratulated not only upon the wisdom and foresight of its technical advisers, but on the courage and broadness of its management. We believe that this change will prove one of the best investments that the company has ever made; that its passenger traffic will grow by leaps and bounds within the suburban area, and that the New York Central will become more than ever a household word, less deserving of blame and more worthy of praise than ever before in its history.

It will, of course, be two or three years before even the first portions of this grand scheme can be carried through, but the die has been cast and forthwith the change is to be inaugurated, which at the end of a half decade will cause the whistle, the smoke and the fumes of that magnificent old servant of civilization, the steam locomotive, to be utterly unknown throughout this region. With such things happening we hardly think anybody ought to worry about the future of electricity.

It is significant to note that the direct-current system is to be employed rather than the alternating. We have a belief that at no distant date the alternating system of traction will have vindicated itself, but for the present it must be accepted that the arguments were overwhelming in favor of direct-current traction when adopted by such progressive men as Messrs. Sprague and Arnold, and the engineers associated with them on the commission. The adoption of the steam turbine in the power plant instead of the reciprocating engine is also an event fraught with great suggestiveness, for it may be taken as granted that in this battle royal of motive powers the standard type of engine was put on the very best plane of competition. Another striking feature is the fact that the multiple-unit system which upon its introduction was regarded as a more or less promising scheme for hitching up trolley cars, is now found applicable and desirable for tractors of the size of these immense locomotives, so that two of them working together can dally lightly with the biggest trains that the Central system has ever known. Other details are not yet forthcoming, such as those relative to the traveling contacts of the locomotives, the location and nature of the substations, the switching and signaling, and last but not least the terminal facilities, but they will be settled with equal care and deliberation.

Testing Alternators Under Full Load Conditions.

In pursuance of a practically important subject recently discussed by Mr. Behrend, we print on page 873 an article by Mr. Waters, on modifications of the Mordey test of alternators. Mr. Waters points out that the method of opposing field coils and the method of opposing armatures, give results which are unreliable in regard to regulation, and are also apt to exaggerate the iron losses, to the prejudice of efficiency.

These criticisms apply particularly to the case where the opposition of coils or poles is not half against half, but a lesser against a greater part, so as to leave a working residual number. When, for example, 13 armature coils are opposed to 11, the voltage disturbance due to the distortion of magnetic flux in the machine at the points of reversal, must tell heavily upon a residual e.m.f. of two coils alone; and the regulation of the machine, as deduced in this manner, might be expected to be considerably affected thereby. A lesser discrepancy might be looked for by the opposition of say 16 coils against 10, and still less with 16 coils against 8; since the voltage disturbance would then be shared between 4 and 8 coils, respectively.

These conditions are interestingly expressed in Mr. Waters's diagrams, where, with 16 poles against 8, the deviation from the full series condition is about one-quarter of that with 13 poles against 11. It is also instructive to observe that when the armature was divided against itself, the apparent regulation was better than the normal; whereas, when the field was divided against itself, the apparent regulation was worse than the normal, for the machine referred to. In this particular, the method previously suggested by Mr. Behrend on page 715, has the apparent advantage that by opposing the two halves of the field with a controlled excitation in each half, there is less general distortion of the magnetic flux, and the error of distortion is divided equally among all of the armature coils. It seems possible, therefore, that the regulation test would give somewhat better results by the Behrend method. At the same time it must be conceded that no method of field or armature opposition is likely to give accurate results in tests of pressure regulation, owing to the magnetic flux distortions at the points of reversal. As pointed out in the article, the greatest advantage derived at the present time from the opposition of armature halves is the test for temperature elevation by supplying the full-load IR losses, either from without or from within. If the factory regulation tests of large alternators ordinarily used could be agreed upon, and relied upon, with the same degree of security as the efficiency and heating tests, the art of testing large alternators under full-load conditions would be placed in a very satisfactory condition. Mr. Behrend has a letter on the subject in this issue.

How Not to Heat Third Rails.

There are times when it is well to contemplate the things which one cannot do electrically. Electricity possesses marvelous possibilities, but now and then it comes with the traditional sickening thud up against propositions undeniably out of its line. One of these seems to be melting sleet on a third rail by electrically-heating the same. In a note published in our last issue Mr. Del Mar grimly calculated the amount of energy necessary to accomplish the feat. The figures are somewhat startling. On very conservative assumptions as to the amount of heating required, the energy comes out of the calculation at 3,800 kw for a line having 50 miles of third rail merely for melting 1/100 inch of sleet, while more than double this amount additional would hardly maintain the rail at a temperature that would make melting possible.

The question of sleet is always with us, and each winter furnishes fresh material for thought. On Mr. Del Mar's showing we fancy that no one will have the temerity to try electrical heating as a remedy for sleet, and the scraper is likely to continue its pyrotechnic career at least for the present. Sleet on trolley wires is quite bad enough, but the conditions on the third rail are infinitely worse. As a matter of fact, scrapers give pretty good results when used assiduously, but the ice coating forms rapidly and if it once gets a good start it is likely to keep ahead of the game. The elevated roads with their constant succession of trains can keep the rail fairly clear, but woe betide the long road with infrequent stops when once the sleet gets down to business. The protected third rail strikes one as advantageous in dealing with sleet, as in many other respects, but it has not yet been thoroughly tried out on a large scale and sleet storms are happily too infrequent for experience to accumulate rapidly.

After all, it is still open to question whether the third rail is to have a permanent place in the art, save perhaps on elevated or underground lines of moderate length. There is much in its favor as a practical solution of immediate difficulties, and it has in some instances done extremely good service. But it does not lend itself readily to the delivery of energy at anything but very moderate voltages, and it may be regarded as altogether probable that the

larger future work of the electric railway will demand high voltage working conductors. The Zossen experiments have shown how easily large amounts of energy can be supplied from overhead wires to a moving train with sliding contacts when high voltage is used; and when heavy and fast electric railroading is seriously undertaken supply at high voltage seems quite certain to be adopted. We should much like to know how the conductors on the Zossen line would stand up to their work in a really first-class sleet storm, but it is undeniable that at 10,000 volts an ice film is a less serious obstacle than at 500 or 600 volts. Fortunately, hereabouts, i. e., in New York City, most of the third-rail work will be underground where sleet cannot get at it, or overhead on elevated lines where the service is very frequent, and where the early troubles with sleet are hardly likely to be repeated. But lines operating with the third rail in open country have serious work confronting them. The hot water remedy for sleet referred to by Mr. Del Mar seems to us little more worthy of consideration than electrically-heating the rail, particularly on long lines, and the scraper in one form or another seems by all odds the best remedy at hand. In dealing practically with sleet, persistent application counts for more than anything else. As in fighting a snow storm on a street car line, the one thing needful is to begin work at the first intimation of trouble and to keep it up as long as the flakes fly. A very moderate storm suffices to stall the cars if it gets a start and begins to hold them up. The first car that stops blocks effective assistance and by the time the shovel brigade comes into action, the service is thoroughly demoralized. So, when the sleet comes on, the thing which counts is the equipment of every train for immediate action, and the initiation of a fight all along the line, day and night. Thus shall the passengers get home and peace reign over the system.

THE METRIC SYSTEM AND FOREIGN TRADE.

On page 883 appears a communication from Mr. G. W. Colles, in which he cites the answers by prominent members of the French Society of Civil Engineers to certain anti-metric questions propounded by the American Chamber of Commerce. He employs these answers in support of an argument that it is better for us to keep to the customary British system of weights and measures than to change to the international metric system. We have no fault to find with the French replies to these American questions. The questions propounded, however, are clearly biassed antimetrically. We dissent only from Mr. Colles in the deductions he draws from the replies.

It is quite reasonable that when cargoes of goods are shipped to a metric country for distribution, it does not matter very much whether the goods appear on the bill of lading in cubic feet, cubic versts, cubic cubits or cubic Flemish ells, so long as a correct numerical relation is known between the foot, verst, cubit or Flemish ell, and the metre. The labor of the calculation once effected on a cargo of hundreds of tons does not appreciably alter the retail cost of a distributed kilogramme. Nor is it likely to be of much concern to a manufacturer in Great Britain or America that he makes goods by the yard or pound, when he has a competent agent abroad to make propositions to buyers abroad on the international metric basis. The agent merely has a little extra trouble with the computation and exchange. But where there is no agent, a would-be purchaser who has a catalogue of British or American commodities in pounds, avoirdupois; gallons, imperial or American; bushels, dry, liquid or otherwise, may be lost, and sometimes is lost, by the extra inconvenience of interpreting these crude and ambiguous units into international measure. The warning burden of the sermons preached for years by British foreign consuls to Britons, and by American foreign consuls to Americans, is found, in the consular literature, insisting on the importance of catalogues abroad with quotations in metric measures. The consensus of opinion of these trade experts abroad appears to be that England and America are handicapped, to some extent, in the markets of the rest of the world by their clinging to a ridiculous and mediæval system of units.

As regards the replies to the effect that non-metric American machinery can be used in metric Europe, we not only subscribe to that view, but we regard it as a strong argument in favor of the adoption of the metric system. Practically all fair-minded persons admit, after studying the question adequately, that it would be better if we had the metric system in this country, and in other English-speaking countries, with its three simple units—the gramme, metre and litre—instead of our antiquated old medley with its sixty odd and difficult units. But many oppose a change to the metric system because they say it would prevent our machinery from being used. They argue that a machine with inch parts will in some way be rendered useless to the community when the community measures in metres or decimals thereof. If such were, indeed, the case, it would be better not to have any metric system here, burdensome as our own system is, since the loss to the community in machinery, tools and mechanical products would be enormous and prohibitive. The clearest proof, however, that no such danger exists is found in the facts cited by Mr. Colles, that non-metric machines may be, and are, conveniently used in metric countries. Consequently, no machine manufacturer need fear loss of machinery, or of products, by reason of the national adoption of the metric system.

It is true that the British inch, foot, yard, engineer's link, surveyor's link, span, fathom, pole or perch, surveyor's chain, engineer's chain, bolt, furlong, league and mile would all probably retain obscure and occasional existence in this country, for a century or more after the decimalization of linear measurement, by the adoption of the metric system. It is equally true that in this country to-day we still find the "shilling" occasionally used, 119 years after the date of the national decimalization of our money. Nevertheless, we stand for the proposition that this United States does use a decimal currency at this time, and furthermore it is our profound belief that in this decimal currency we have one which is much superior to the antiquated British currency that preceded it.

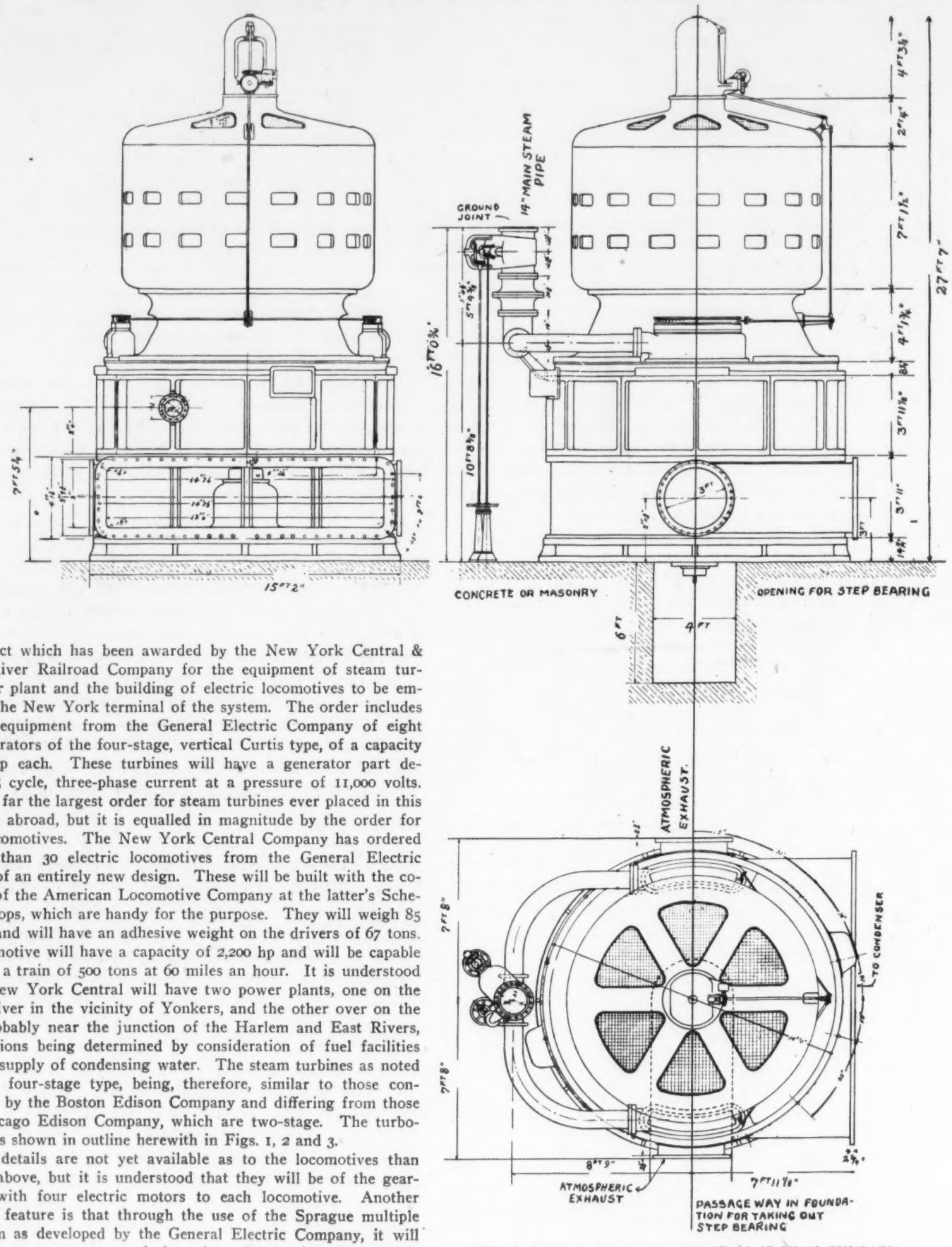
If Mr. Colles thinks there is no chance of Great Britain nationally adopting the metric system, we think the evidence is against him. The colonial premiers strongly urged the British and colonial governments to adopt the metric system at their conference of August, 1902. The Fifth Congress of the Chambers of Commerce of the British Empire at Montreal passed a yet stronger resolution in favor of compulsorily adopting the metric system, in August, 1903. The Association of Trade Protection Societies, numbering about 40,000 British commercial men, passed a resolution in favor of the metric system, in May, 1902. The Transvaal Chamber of Mines reported in favor of the metric system in November, 1902. The Federal Parliament Houses for Australia passed resolutions favoring the compulsory adoption of the metric system, in all parts of the British Empire, in June, 1903. The Cape of Good Hope House of Assembly agreed to a motion in favor of the adoption of the metric system in August, 1903. The Lancashire and Cheshire Federation of Trade and Labour Councils adopted a resolution in favor of a compulsory change to the metric system in January, 1903. The Association of Inspectors of Weights and Measures pronounced in favor of the early adoption of the metric system in May, 1903. The New Zealand Parliament has recently passed a bill exclusively introducing the metric system there in 1906.

Electric Traction for the New York Central Railroad.

One of the most momentous and important events in the history of steam locomotion and the ultimate supersession of the steam locomotive by the electric locomotive is to be recorded this week in the contract which has been awarded by the New York Central & Hudson River Railroad Company for the equipment of steam turbine power plant and the building of electric locomotives to be employed at the New York terminal of the system. The order includes an initial equipment from the General Electric Company of eight turbo-generators of the four-stage, vertical Curtis type, of a capacity of 7,500 hp each. These turbines will have a generator part delivering 25 cycle, three-phase current at a pressure of 11,000 volts. This is by far the largest order for steam turbines ever placed in this country or abroad, but it is equalled in magnitude by the order for electric locomotives. The New York Central Company has ordered no fewer than 30 electric locomotives from the General Electric Company of an entirely new design. These will be built with the cooperation of the American Locomotive Company at the latter's Schenectady shops, which are handy for the purpose. They will weigh 85 tons each and will have an adhesive weight on the drivers of 67 tons. Each locomotive will have a capacity of 2,200 hp and will be capable of hauling a train of 500 tons at 60 miles an hour. It is understood that the New York Central will have two power plants, one on the Hudson River in the vicinity of Yonkers, and the other over on the Sound, probably near the junction of the Harlem and East Rivers, both situations being determined by consideration of fuel facilities and ready supply of condensing water. The steam turbines as noted are of the four-stage type, being, therefore, similar to those contracted for by the Boston Edison Company and differing from those of the Chicago Edison Company, which are two-stage. The turbo-generator is shown in outline herewith in Figs. 1, 2 and 3.

Further details are not yet available as to the locomotives than are given above, but it is understood that they will be of the gearless type with four electric motors to each locomotive. Another interesting feature is that through the use of the Sprague multiple unit system as developed by the General Electric Company, it will be possible to operate two of these huge locomotives in multiple unit for the heaviest trains on the system, so that not a train within the radius of 40 or 50 miles from New York City would require to come in under steam. As each of these locomotives singly would give easily 2,200 hp, they would have a capacity to develop jointly not less than 4,500 hp, or practically three times as much as the best steam locomotive record. The ability, therefore, to take care of even the heaviest through express trains with the weightiest Pullmans may at once be predicated.

The obligations laid upon the New York Central by the authorities were that they should be ready to make the change so far as the Park Avenue Tunnel was concerned; but the nuisances and discomforts of that tunnel are abolished in the adoption of the larger scheme, which will virtually take care also of all of the suburban traffic of the line out to the extreme limits of commuter travel. It had been generally supposed that the company might limit its change



FIGS. 1, 2 AND 3.—DIAGRAMMATIC VIEWS OF TURBO-GENERATOR.

of motive power to the city limits on Manhattan Island, but the plan now adopted is seen to involve such points as Croton, White Plains, New Rochelle and other well-known boundaries of New York suburban traffic. The point has arisen as to the interchange of traffic with the Interborough Rapid Transit system, but the tunnel of the subway having only a clearance of 13.7 ft., it is obvious that standard coaches could not be run through it.

The total cost of the change in equipment of power plant, locomotives, etc., is estimated at between $15,000,000 and $20,000,000. At the present time no details are forthcoming as to the sub-stations, the location and equipment of which, involving contracts for transformers, rotaries, storage batteries, etc., are understood still to be under study and consideration. A report is current that contracts have been awarded for Babcock & Wilcox boilers that will run up to 40,000 hp, but it has not been verified as we go to press.

The commission appointed by the New York Central Company to consider the electrification of the road's terminals has now been in session for some months under Vice-President Wilgus, who happens at this moment to be abroad in Europe, accompanied by an architect, and who is said there to be studying European stations in view of the development of the facilities at the Grand Central Depot in connection with this new work and the rapid growth of business on the New York Central. Others representing the railroad in connection with the commission are Messrs. Deems, Gibbs, Katte and Waitt; while the consulting electrical engineers are, as is well known, Messrs. B. J. Arnold and Frank J. Sprague. More recently, in connection with the power house plans, Mr. Frederick Sargent, of Chicago, has been retained in an advisory capacity in order that the commission may avail itself from time to time of his experience as one of the leading designers and constructors of power

It is assumed or understood that for straight run work, the third-rail method in some form will be adopted, although this would not be applicable around the yards. It is further understood that the locomotives will operate at a pressure around the normal 550 volts, so as to render available the resources of current supply obtainable in and around New York City, as a further guarantee of uninterrupted operation.

The Latest Work at Zossen.

CABLE dispatches just to hand announce the closing for the season of the memorable series of tests made on the Zossen road near Berlin with high-speed electric locomotives, at which velocities of over 130 miles an hour have been reached. We are also in receipt from Dr. Walter Reichel, of the railway department of the Siemens-Schuckert Company, of some further views and data relative to this striking work with which his own name has been so prominently and honorably associated.

As was noted in our issue of October 31, during the twenty-two months that have elapsed since the close of the first experiments the track from Marienfeldt to Zossen had been taken up and relaid with new steel rails weighing 41 kg (86.1 pounds) per lineal meter, resting on heavy spruce ties 22 in. from center to center and heavily ballasted with broken basalt. The rails are set on each tie in a steel chair, strongly bolted down, and are joined perpendicularly by beveled joints, 7 in. in length, held firmly together by bolts passing horizontally through the fishplates, so that the effectiveness of a continuous rail is practically secured. The old light rails, which had failed in 1901 and were, therefore, taken up, have been laid down flat as guard rails, resting horizontally on special cast-iron chairs in such a way that the flat bottom flange of the rail stands vertically along the inside line of each heavy rail and about 2 in. distant from the inner edge of its face. A view of the track is shown in Fig. 2. The track is a nearly level air line throughout its length, except one curve of 2,000 yards radius near its southern extremity, and is in all respects up to the highest standard of modern railway construction. The motors have been likewise improved in various minor details, but the cars are substantially the same as when first constructed. The car now shown in Fig. 1 was first shown in our issue of November 9, 1901, but was then without the wheel guards and brushes, the ventilators for the side rheostats, the hand rails on the roof, the extra springs seen in the three contact arms, and other minor details. Each is 22 meters (72.18 ft.) in length and weighs 90.5 metric tons, or about 200,000 pounds avoirdupois. Of this weight 48 metric tons comprise the body and running gear, and

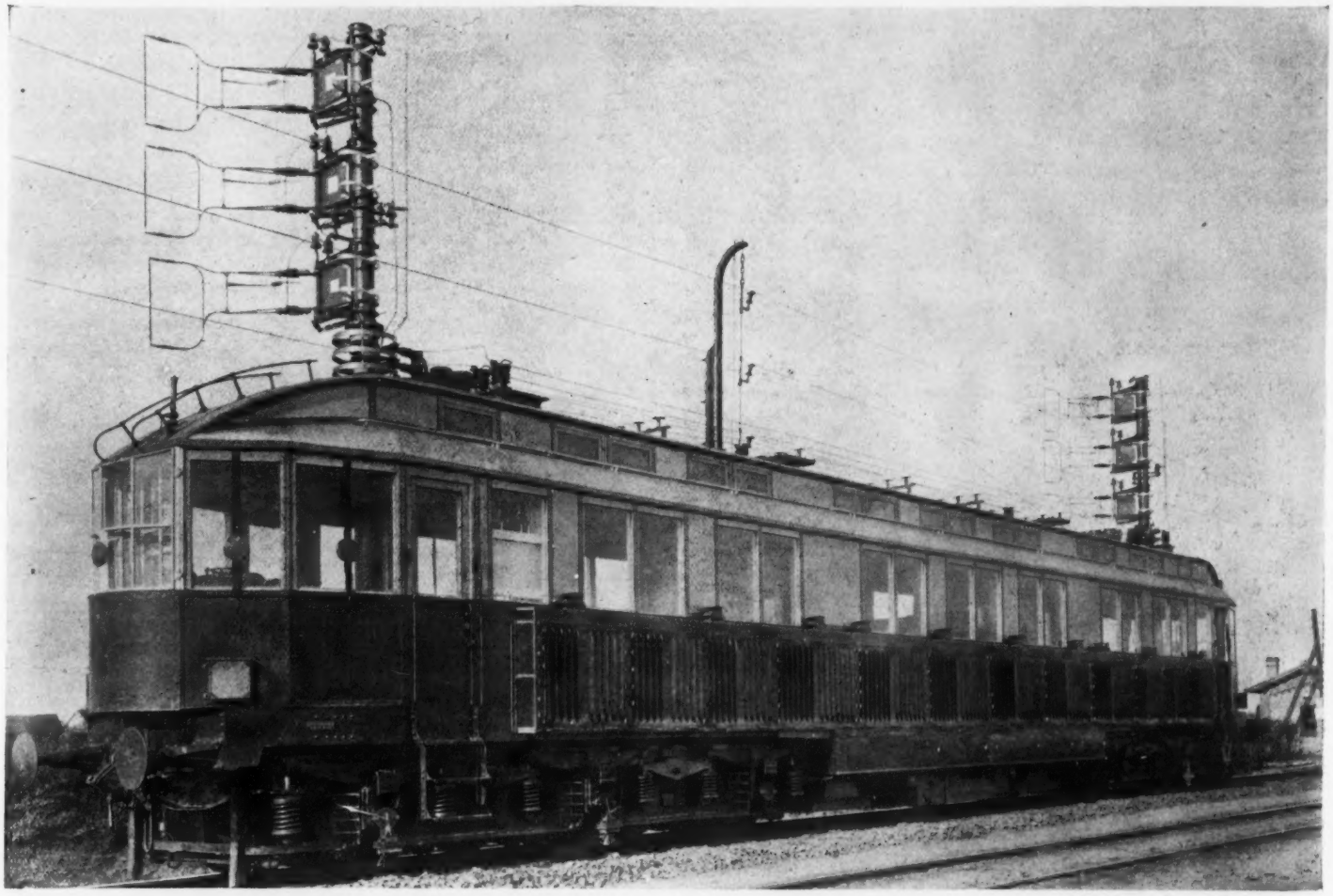


FIG. 1.—VIEW OF HIGH-SPEED CAR ON ZOSSEN ROAD.

42.5 tons are made up by the motors, transformers, and other details of the electrical equipment. Each end of the car rests on a six-wheel bogie truck of the American type, and the motors are four in number, one attached to the front and rear axle of each truck, the middle pair of wheels in each group running free. The wheels are 49 in. in diameter and are equipped with Westinghouse pneumatic brakes of the standard type. The transformers, which are hung beneath the middle section of the car, weigh 12 tons, besides which a storage battery of 631 pounds weight supplies the current for lighting purposes. The interior of the car is provided with upholstered seats lengthwise along the sides, and an open railing encloses at each end the space occupied by the driver.

As to results and observations during the trip, Dr. Reichel says: "After all arrangements have been made and the military posts along the line notified, the current is allowed to enter the car at 14,000 volts. We leave Marienfeldt at 25 minutes after 9 and in starting up the current in each of the four motors is gradually

FIG. 2.—VIEW ALONG THE ROAD.

raised to 350 amp., making the total power used 3,300 kw, or about 2,600 hp. The feeding point is passed at 80 km. an hour. * * * By the time Mahlow is reached (7 km. from Marienfeldt) a speed of 180 to 185 km. has been attained, and yet the train runs over the switches at this point without any particular shock. At this speed it is noticed that the current-collecting devices are still running quietly and there is, therefore, no scruple as to further increasing the speed. The last resistances are gradually cut out under the load of 2,300 kw and the speed rises to the hitherto unreached figures, 190 and 195. While traveling at 195 km. an hour we noticed two people standing in the middle of the track about 800 meters ahead, apparently most calmly discussing high-speed traction with each other. Luckily, they heard the warning whistle of the signal pipe and got out of the way just in time. It would not have been possible to have stopped the 93-ton car within 800 meters, as it requires fully 1½ km. to come to a full stop, at a braking pressure of 200,000 kg. * * * * * * After the trip the car was examined very carefully and showed very little evidence of the demands which had been made upon it. The front of the car is covered with moths, bees and like insects which appear as if they had been crushed fast to the panes of glass and iron work. This is hardly to be wondered at as the air pressure was fully 210 kg. per square meter."

Dr. Reichel indulges in some rather interesting cost comparisons between steam and electricity from the German standpoint. A steam train consisting of a locomotive and five cars weighs 330,000 kg., contains 168 seats and uses 1,400 hp at full speed; the electric train consisting of one motor car and four trailers weighs 260,000 kg., has 180 seats and uses 1,000 hp. The initial cost of both trains is practically the same, being about 400,000 marks ($100,000). The operating cost for simply moving the train is 51 pfennigs (12½ cents) for 100 seat-km., operating with steam, and 49½ pfennigs (11½ cents) using electricity. Applying a calculation to the 150 km., or 94-mile line, between Berlin and Leipzig, we get the following conclusions: On this line an 18-hour service is furnished and 36 trains a day run every hour in both directions, so that if 40 per cent. of the seats are occupied (the trailers are put on when necessary) about 2,500 passengers are accommodated. Figuring the fare per kilometer as 6 pfennig (1½ cents), which is the present second-class fare, this would give a daily income of 22,500 marks ($5,650). The operating expenses, considering transportation only, are about 5,000 marks daily ($1,250). Adding to this the other operating expenses, particularly for employees, maintenance of way, stations, management, etc., 7,600 marks daily, this would make the daily operating expense 12,600 marks. This leaves 9,900 marks for interest on the original capital, which in one year would be 3,600,000 marks, which would give 4 per cent. interest on 90,000,000 marks. The cost per kilometer would, in this case, be about 600,000 marks.

Independent Telephone Convention at Chicago.

The regular annual convention of the Interstate Independent Telephone Association will be held at the Auditorium, Chicago, on December 8, 9 and 10. The programme, which is as follows, promises a most useful and interesting affair, and a large attendance is expected by the officers:

Tuesday Morning, December 8, 9 to 12—Reception of members and friends by the Executive Committee and officers at the secretary's headquarters. Tuesday Afternoon, December 8, 2 to 5—Address of welcome, Hon. Carter H. Harrison, Mayor of Chicago. Response and annual address by president, Senator C. E. Hull, Salem, Ill. Report of the secretary. Report of the treasurer. Selection of Executive Board. Selection of Nominating Committee. Revision of Constitution and By-Laws. Adjournment. Wednesday Morning, December 9—The officers and Executive Board will take charge of the delegates this morning from 9 to 12 in visiting exhibits. Wednesday Afternoon, December 9, 2 to 5—"Should the Territory of the Interstate Independent Telephone Association Be Enlarged, and if so, Why?" Hon. John Van Nortwick, Appleton, Wis. Discussion. "Are Our Telephone Periodicals Sufficiently Careful as to the Business Relations Sustained by Contributors?" Hon. W. H. McDonough, New York. Discussion. "Standardization of Apparatus," Prof. J. C. Kelsey, Purdue University. Discussion. "Standardization of Construction," W. C. Polk, Kansas City, Mo. Discussion. "Competition between Independent Companies and Farmers' Mutuals," O. Rex, North Manchester, Ind. Discussion. Thursday Morning, December 10, 9 to 12—"Independent Toll Line Systems, and Is the Time Ripe for Merging?" J. S. Bailey, Jr., Toledo, Ohio. Discussion. "Where Should the Line of Demarcation Be Drawn between Independent Operating and Manufacturing Companies, and the Bell Company?" Hon. Henry A. Barnhart, Rochester, Ind. Discussion. "What Should Be the Representation in the Connection of the Interstate Independent Telephone Association in Voting?" Mr. Prewitt, Winchester, Ky. Discussion. "Who is Who? What Are the true Ear Marks?" Hon. Theodore Gary, Macon, Mo. Discussion. Election of officers. Thursday Afternoon, December 10, 2 o'clock on. Officers and Executive Board will entertain the delegates.

The officers of the Association are: C. E. Hull, president, Salem, Ill.; I. A. Frazer, vice-president, Connersville, Ind.; E. M. Coleman, secretary, Louisville, Ky.; J. W. Layne, treasurer, Carthage, Mo.; C. E. Tripp, Auditorium, has charge of exhibit space. An elaborate banquet will close the convention.

Calculation of the Apparent Inductance of Armature Coils.—III.

BY C. C. HAWKINS.

6. *Calculation of the surface-of-core inductance.*

Secondly, the inductance from the *surface of the core* up to the pole tips at a distance of 2_2 cm. from the line of symmetry midway between the poles must be reckoned; for comparative results it is assumed that the group of short-circuited spool sides is situated midway between the poles—an assumption that is not strictly accurate when the brushes are shifted away from the line of symmetry; yet its correction would involve a refinement of calculation to which the value of the results would hardly be commensurate.

The leading cases may be grouped into four or five kinds, according as the short-circuited spool sides are concentrated in one slot, or divided between two, three, four or five slots. Since the distribution of the spool sides is often different in the two considered interpolar zones, it is best to take them separately and add the two

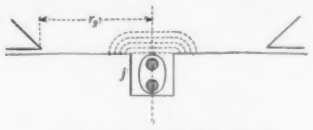


FIG. 15.—SINGLE SLOT.

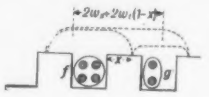


FIG. 17.—TWO ADJACENT SLOTS.

inductances together, so that the following formulæ are arranged to apply to a single interpolar gap.

(1) When the short-circuited spool sides are confined to a single slot (Fig. 15). The permeance in one interpolar zone per cm. length of armature core is $\frac{2.3}{\pi} \log \frac{\pi \left\{ r_2 - \frac{w_s}{2} \right\} + w_s}{w_s}$ acted on by a m.m.f. of $4\pi j w$, where j is the total number of short-circuited spool sides in the one zone and w = the number of wires in a spool side $= \frac{\tau}{2N_2}$. The resulting flux is linked with the w wires of the considered section, so that the self and mutual inductance is

$$\frac{2.3}{\pi} \log \frac{\pi \left\{ r_2 - \frac{w_s}{2} \right\} + w_s}{w_s} \times 4\pi j w^2 \times 10^{-9} \text{ henrys;}$$

since $w^2 = \frac{1}{4}\left(\frac{\tau}{N_2}\right)^2$, the coefficient required for insertion in our principal equation is for the single zone and per cm. length of core,

$$b = j\, 2.3 \log \frac{\pi \left\{ r_2 - \frac{w_s}{2} \right\} + w_s}{w_s}.$$

It is of interest to plot the value of $2.3 \log [\ ]$ as an indication of the rapid rise of the inductance for small distances away from the center line as on small armatures and the gradual decline in the rate of increase as the width of the interpolar zone is increased (Fig. 16, upper curve). For the width of the slot two specimen cases are chosen, viz.: $w_s = \frac{1}{4}''$ or $w_s = \frac{1}{2}''$, and other cases might be interpolated by alteration of the scale of abscissæ, if special accuracy was required. Further, it is throughout assumed that the ratio $\frac{\text{polar arc}}{\text{pole pitch}} = \beta = 0.7$, so that by altering the scale of abscissæ, as shown in Fig. 16, the same curve can be applied directly to cases involving different numbers of poles. The actual position of the short-circuited spool sides within the slot is in connection with the present section immaterial, and the figures are equally applicable to any winding, so long as the multiplier, j, is given the correct value.

(2) When the short-circuited spool sides in one interpolar zone are confined to two adjacent slots, but are not necessarily equally divided between them, let f = the number of spool sides short-circuited in the slot which has the greater number, and let g = the smaller number within the other slot. At some point along the central tooth the flux is zero, and thence the local flux surrounding each slot gradually increases, but as a first approximation it will suffice to calculate the permeance of each slot at its full value up to the dividing point, x (Fig. 17). The fraction x of the intervening tooth, which the local flux surrounding f traverses, will increase as $\frac{f}{g}$ increases, and is given by the relation $\frac{f}{\pi x w_t + w_s} = \frac{g}{\pi w_t (1-x) + w_s}$. Beyond the limits of the local fluxes, the permeance up to the pole tips is per cm. length of core,

$$\frac{2.3}{\pi} \log \frac{\pi \left[r_2 - \left\{ w_s + w_t (1-x) \right\} \right] + 2 w_s + 2 w_t (1-x)}{\pi x w_t + 2 w_s + 2 w_t (1-x)}$$

whence for substitution in our principal equation, for one zone,

$$b = (f+g)\, 2.3 \log \frac{\pi \left[r_2 - \left\{ w_s + w_t (1-x) \right\} \right] + 2 w_s + 2 w_t (1-x)}{\pi x w_t + 2 w_s + 2 w_t (1-x)}$$

To the inductance from the joint flux must be added that from the local flux, for which

$$b^1 = f \times 2.3 \log \frac{\pi x w_t + w_s}{w_s}, \text{ or } = g \times 2.3 \log \frac{\pi (1-x) w_t + w_s}{w_s}$$

according to whether the considered spool side belongs to the f or to the g group.

If $f = g$, $x = 0.5$; otherwise the ratio $\frac{w_s}{w_t}$ must be known; thus if $\frac{f}{g} = 2$, and if, in order to indicate the class of effect $w_s = w_t$ be assumed, $x = \frac{2\pi + 1}{3\pi} = 0.77$; or, if $\frac{f}{g} = 3$, $x = \frac{3\pi + 2}{4\pi} = 0.91$.

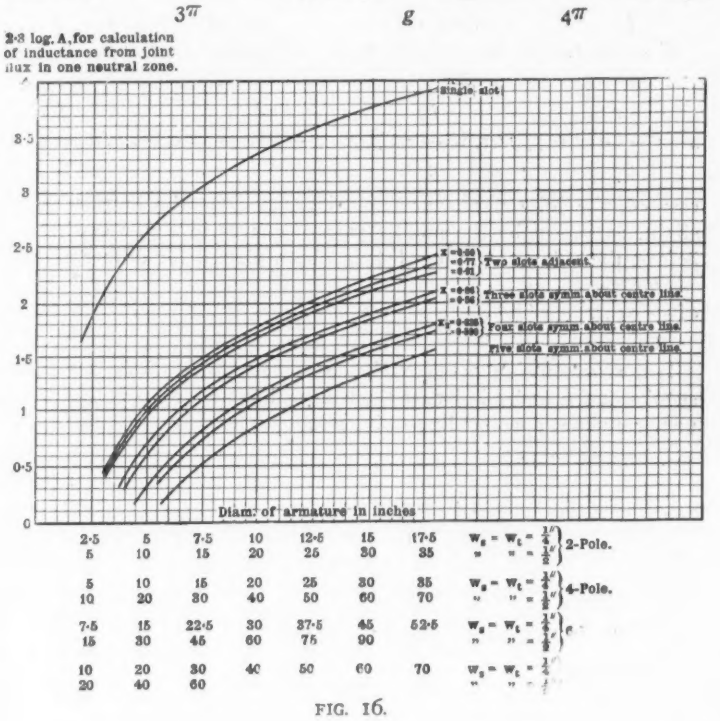

2·3 log. A. for calculation of inductance from joint flux in one neutral zone.
Single slot.
Two slots adjacent.
Three slots symm. about centre line.
Four slots symm. about centre line.
Five slots symm. about centre line.
Diam. of armature in inches
2-Pole.
4-Pole.
6-Pole.
8-Pole.

FIG. 16.

As x increases, the permeance for the joint flux decreases, but the diminution is so small as to have but little effect, as shown by the proximity of the three curves in Fig. 16, appropriate to the above three cases. Further, a relation between w_s and w_t differing widely from unity, has no great effect on the whole, since a consequent

change in b is partially counterbalanced by an opposite change in b', so that if an average is struck between w_s and w_t, it is seldom necessary to consider their actual values more closely.

If, while the short-circuited spool sides are confined to two slots a central slot intervenes which is empty, the local permeance may, in the case of each slot, be extended up to the full width of the

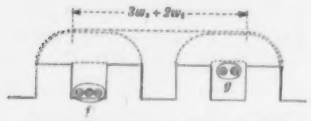


FIG. 18.—TWO SLOTS WITH INTERMEDIATE VACANT SLOT.

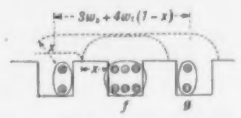


FIG. 19.—THREE SLOTS SYMMETRICAL ABOUT CENTER LINE AND CENTRAL SLOT MOST FILLED.

tooth, while the joint permeance then has its lower limit fixed by the central gap of four teeth and three slots (Fig. 18). The coefficients are then

$$b = (f + g)\ 2.3\ log \frac{\pi \{ r_2 - (1.5\ w_s + w_t) \} + 3w_s + 2w_t}{\pi\ w_t + 3w_s + 2w_t}$$

and

$$b' = f \times 2.3\ log \frac{\pi\ w_t + w_s}{w_s}, \text{ or } = g \times 2.3\ log \frac{\pi\ w_t + w_s}{w_s},$$

as the case may be.

(3) If the short-circuited spool sides are spread over three slots the center containing the larger number, f, and further, the two outside slots each contain g spool sides, so that the whole is symmetrical about a center line (Fig. 19), x is given by the relation,

$$\frac{f + g}{\pi\ x\ w_t + 2\ w_s + w_t} = \frac{g}{\pi\ w_t\ (1 - x) + w_s}, \text{ whence}$$

$$b = (f + 2g)\ 2.3\ log \frac{\pi\ [r_2 - \{ 1.5\ w_s + 2\ w_t\ (1 - x) \}] + 3\ w_s + 4\ w_t\ (1-x)}{\pi\ x\ w_t + 3\ w_s + 4\ w_t\ (1-x)}$$

and

$$b' = f \times 2.3\ log \frac{\pi\ x\ w_t + w_s}{w_s}, \text{ or } = g \times 2.3\ log \frac{\pi\ (1-x) w_t + w_s}{w_s}$$

If $\frac{f}{g} = 1$, $x = \frac{2\pi - 1}{3\pi} = 0.56$, while if $\frac{f}{g} = 2$ and $= w_t$

$x = \frac{3\pi}{4\pi} = 0.75$; or, if $\frac{f}{g} = 3$, $x = \frac{4\pi + 1}{5\pi} = 0.86$. As $\frac{f}{g}$ is increased, the joint permeance now increases, yet the increase is but slight, as shown by the middle pair of curves in Fig. 16, where, as before, the value of $2.3\ log\ \{\ \}$ has been plotted for different values of $\frac{f}{g}$ or x.

If the two outside slots contain the same number of short-circuited spool sides, f, and f is larger than g, so that the group is again symmetrical about a center line (Fig. 20),

$$b = (2f + g)\ 2.3\ log \frac{\pi \{ r_2 - (1.5\ w_s + w_t) \} + 3\ w_s + 2\ w_t}{\pi\ x\ w_t + 3\ w_s + 2\ w_t}$$

and

$$b' = f \times 2.3\ log \frac{\pi\ x\ w_t + w_s}{w_s}, \text{ or } = g \times 2.3\ log \frac{\pi\ (1-x)\ w_t + w_s}{w_s}$$

$$\text{If } \frac{f}{g} = 2,\ x = \frac{2\pi + 3}{5\pi} = 0.59,$$

$$= \frac{3}{2},\ x = \frac{3\pi + 4}{8\pi} = 0.535.$$

In this case, as $\frac{f}{g}$ increases, the joint permeance decreases as in case (2).

If the distribution about the center line is unsymmetrical and the center slot has the larger number of short-circuited spool sides (Fig. 21), a sufficiently close approximation will usually be given by the

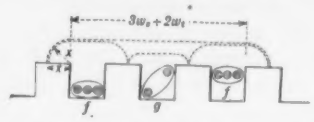


FIG. 20.—THREE SLOTS SYMMETRICAL ABOUT CENTRE LINE AND OUTERS MOST FILLED.

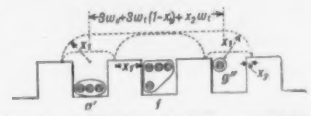


FIG. 21.—THREE SLOTS UNSYMMETRICAL ABOUT CENTRE LINE AND CENTRAL SLOT MOST FILLED.

equations, $\frac{f + g'}{\pi\ x_1\ w_t + 2\ w_s + w_t} = \frac{g'}{\pi(1-x_1) w_t + w_s}$

and

$$\frac{f + g''}{\pi(1-x_2)\ w_t + 2w_s + w_t} = \frac{g''}{\pi\ x_2\ w_t + w_s}$$

the radius x_1 of the joint permeance being fixed by the central slot, whence

$$b = (f + g' + g'')\ 2.3\ log \frac{\pi[r_2 - \{ 1.5 w_s + 1.5 w_t (1-x_1) + .5 x_2 w_t \}] + 3 w_s + 3 w_t (1-x_1) + x_2 w_t}{\pi\ x_1\ w_t + 3\ w_s + 3\ w_t\ (1 - x_1) + x_2\ w_t}$$

and

$$b' = f \times 2.3\ log \frac{\pi\ x_1\ w_t + w_s}{w_s}, \text{ or } = g' \times 2.3\ log \frac{\pi(1-x_1)\ w_t + w_s}{w_s},$$

$$\text{or } = g'' \times 2.3\ log \frac{\pi\ x_2\ w_t + w_s}{w_s}.$$

But if the above equations give x_1 less than $(1 - x_1)$, as may be the case when g'' is small by comparison with $f + g'$, there is a slight error in the above assumption which must be empirically corrected.

If one of the outer slots has the same number of short-circuited spool sides, as the central slot or a larger number (Fig. 22),

$$b = (f + g' + g'')\ 2.3\ log \frac{\pi[r_2 - \{ 1.5\ w_s + \left(1 - \frac{x_1}{2}\right) w_t + 5\ x_2\ w_t \}] + 3\ w_s + (2 - x_1)\ w_t + x_2\ w}{\pi\ x_1\ w_t + 3\ w_s + (2 - x_1)\ w_t + x_2\ w_t}$$

the radius, x_1 of the joint permeance being fixed by the outer slot, and b' is the same as in the last case.

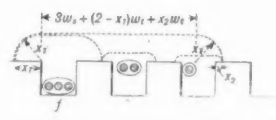


FIG. 22.—THREE SLOTS UNSYMMETRICAL ABOUT CENTRE LINE AND OUTER SLOT MOST FILLED.

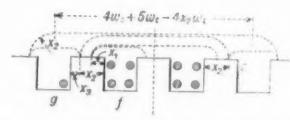


FIG. 23.—FOUR SLOTS SYMMETRICAL ABOUT CENTER LINE AND INNER SLOTS MOST FILLED.

(4) If the spool sides are spread over four slots and are symmetrical about a center line, the two inner slots containing the larger number (Fig. 23), x_1 is given by the relation $\frac{1}{\pi\ x_1\ w_t + w_s} = \frac{2}{\pi\ x_1\ w_t + 2\ w_s + w_t}$, whence it $= \frac{1}{\pi} = 0.32$; while x_2 is given by the relation $\frac{2f + g}{\pi\ x_2\ w_t + 3\ w_s + 2\ w_t} = \frac{g}{\pi(1 - x_2)\ w_t + w_s}$, whence x_2

$$= \frac{(2f + g)\ \pi\ w_t + 2\ (f - g)\ w_s - 2\ g\ w_t}{2(f + g)\ \pi w_t}$$

Thence,

$$b = 2(f+g)\ 2.3\ log \frac{\pi\left[r_2 - \{2\ w_s + 2.5\ wt - 2\ x_2\ wt\}\right] + 4\ w_s + 5\ wt - 4\ x_3\ wt}{\pi\ x_2\ wt + 4\ w_s + 5\ wt - 4\ x_2\ wt}$$

$$b' = 2.3\ f\ log \frac{\pi \times .32\ wt + w_s}{w_s}, \text{ or } g \times 2.3\ log \frac{\pi\ x_3\ wt + w_s}{w_s},$$

$$b'' = 2f \times 2.3\ log \frac{\pi\ x_2\ wt + 2\ w_s + wt}{\pi \times .32\ wt + 2\ w_s + wt}$$

In the particular case when $f = g$, $x_2 = \frac{3\pi - 2}{4\pi} = 0.59$,

$$x_3 = \frac{\pi + 2}{4\pi} = 0.41,$$

$x_1 =$, as always, 0.32;

while when $\frac{f}{g} = 2$, $x_2 = 0.835$ (Fig. 16).

(5) The case of five slots is seldom met with, but for completeness the curve of the value of the logarithmic portion of the expression for the joint permeance in one zone is added in Fig. 16.

Testing Alternators Under Full Load Conditions.

BY W. L. WATERS.

IN ELECTRICAL WORLD AND ENGINEER issue for October 31, Mr. B. A. Behrend describes a modification of the Mordey method of testing large alternators on full load. While advocating the method of connecting the field coils in two groups so that the e.m.f. induced by one group opposes that due to the other, Mr. Behrend does not bring forward any experimental evidence to show that the results as regards heating, efficiency and regulation have any claim to accuracy.

Some years ago when alternators were first made in sizes too large to be conveniently tested on full load, the question of the accuracy of the results obtained by the Mordey method of testing had to be considered, and the writer made a number of tests to decide this point. The results showed that, though the method was sufficiently accurate as regards heating, it was unreliable in regard to efficiency and regulation.

The Mordey alternator consisted of a stationary disc armature and a revolving field so that the form of test suggested by Mordey was to reconnect the stationary armature coils in two groups, the e.m.f. of one opposing the e.m.f. of the other. The disc alternators of Siemens and Ferranti consisted of a revolving armature and stationary magnet, so that when the Mordey test was applied to these machines the natural modification was made to connect the field coils in two opposing groups, instead of the armature coils. When the method was applied to modern iron-clad alternators the connections were made on the magnets or armature coils, according to which was the stationary element—there being natural objections to making temporary false connections on the revolving winding.

Considering first the case in which the armature coils are connected in two opposing groups. The temperature test was made by closing the circuit of the reconnected armature coils through an adjustable resistance, then exciting the magnets at normal no-load excitation and adjusting the armature resistance till the normal current was flowing through the armature. The efficiency test was made in the same way—the full-load losses in the alternator being the power supplied to the machine during this test less the power lost in the external adjustable armature resistance. The regulation test was made by running a similar test, the armature circuit being closed through an external adjustable resistance, inductive or non-inductive, as the case might be, and the excitation adjusted to give normal voltage at the armature terminals (the voltage being, of course, refered to the number of effectiye and not to the total number of armature coils) and external armature resistance varied till the current flowing bore the same ratio to the normal full-load current of the machine as the number of effective armature coils bore to the total number, e. g., if we have the 12-pole machine connected four coils opposing eight, then the number of effective coils would be four and the volts at the armature terminals during the test would be one-third of the normal voltage and armature current would be one-third the normal full-load current.

If the field coils were connected in opposing groups instead of the armature coils, then the tests would be conducted in the same manner, except that in the efficiency and heating tests it was usual to adjust the armature current by raising or lowering the excitation in one of the groups of field coils independently of that in the other, instead of by means of an external armature resistance. The regulation test was sometimes run in the same way, but more usually the external resistance was varied in order to adjust the armature current—the external resistance being a necessity in this test in order to vary the power factor and the load, and in addition it is, if anything, more accurate to work the two parts of the armature at the same flux when the machine is on no-load rather than at the same flux when on full load.

There was always more or less jarring and vibration when running these tests, both on ironless and on iron-clad alternators, but unless the machine was mechanically weak there was never any serious trouble from this cause, at any rate on machines up to 750 kw.

As regards the accuracy of the results obtained by these methods. The temperature test usually gave fairly correct results, for both

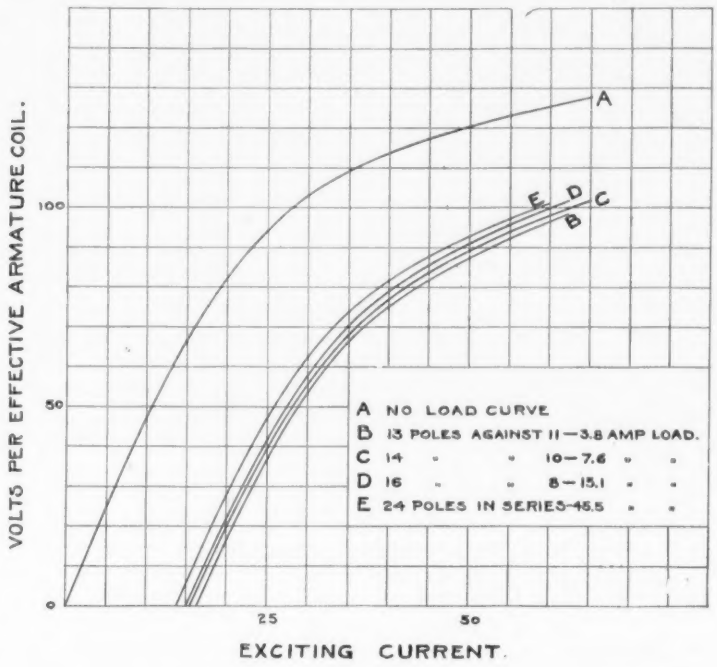


FIG. 1.—MAGNET POLES CONNECTED IN TWO OPPOSING GROUPS.

ironless and iron-clad armatures. Temperature tests are rarely correct within less than 10 per cent., and as carefully-designed alternators are always well within the guarantees as regards heating any small inaccuracies in this method of making the temperature tests are of small importance.

The efficiency test usually gave poor results. During the test the lag of the current in the armature is usually not far from 90°, so that any eddy currents in the iron due to the armature current are considerably increased and the efficiency comes out lower than if the test had been made on a non-inductive load.

The regulation test was usually unreliable, the results obtained varying quite considerably with the method of connection used in the field or armature. Figs. 1 and 2 show the results of regulation tests made on 100-kw, 2,200-volt, 60-cycle, 24-pole, single-phase revolving-field, iron-clad alternator. The various connections of the armature and field coils are indicated in the figures. The tests were made as described above and the results are only plotted for power factor zero—the external resistance being in this case self-induction coils which had a power factor of .1 to .15. The observed volts are divided by the number of effective coils, so that the plotted voltages are volts per effective armature coil. The armature current in amperes bears the same relation to the normal full-load current of 45.5 amp. as the number of effective armature coils bears to the total number of coils, i. e., to 24. The tests made and plotted

in this way are directly comparable and we can see at once from the curve that the results of the test are not by any means consistent. The results of the straight test with all coils in series gives a regulation of 37 per cent., while the different methods of connecting the armature and field coils give results varying from 32 to 41 per cent. This test is simply given as an example—tests on other machines and with different power factor loads gave similar results. The results were sometimes more consistent and at other times less so, but the results appeared so unreliable that this method of obtaining the regulation was abandoned as being of little value.

At the present time the general method of taking the heat run on a large machine is that described in the editorial notice of Mr. Behrend's paper in ELECTRICAL WORLD AND ENGINEER of October 31. The alternator is excited at normal excitation and then the armature coils reconnected to give no result of P.D. and at the terminals and then direct current is sent through the armature to produce the required C^2R loss. The efficiency test is usually made by taking the core loss on no load and then measuring the C^2R losses in the armature and magnets. The regulation test on power factor 1 is a very difficult test to make with any accuracy and so is seldom made. The

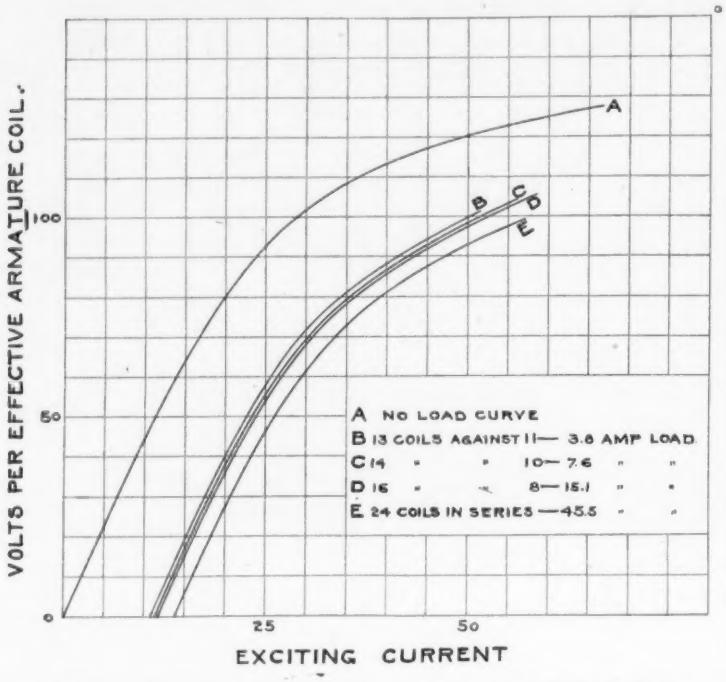


FIG. 2.—ARMATURE COILS CONNECTED IN TWO OPPOSING GROUPS.

regulation test on power factor 0 can be made on a small alternator by loading it up on induction coils (usually field magnet coils), while on large alternators it is best made in the way referred to by Mr. Behrend, by taking a second machine and running it as a synchronous motor and then adjusting the excitation of the two machines till full load current flows between the machines.

Thus, though the Mordey test gives good results on a temperature run, and has done excellent work in the past, the trouble of making the necessary connections, and then the necessary adjustments to get the load right, have caused it to be abandoned in favor of simpler methods, so that at the present time it is practically never used.

National Electric Light Association.

It will be remembered that the proceedings of the National Electric Light Association convention at Chicago this year were of unusual scope and bulk, papers and discussions being alike of importance. The work of preparing the annual volume of transactions has been quite formidable, but the secretary hopes soon to have it ready for issue. It promises to make a substantial volume of not far short of 1,000 pages, which, with its special appendices—one of them in colors—will constitute the best example, up to date, of the Association's efforts in behalf of its members, particularly those who are unable to attend the meetings. The volume will be eagerly sought after when issued.

Meeting of Southern Indiana Independent Telephone Association.

The Independent Telephone Association of Southern Indiana held its fourth annual convention in Evansville November 11 and 12. There were about 75 delegates present and a host of visiting representatives from telephone manufacturers.

The convention was presided over by Vice-President Knoefel, of New Albany. W. E. Clark, city clerk, read Mayor Covert's address of welcome. The Mayor said it was with pleasure he welcomed the independent telephone men to Evansville, but regretted the fact that the doors of the city had, up to the present time, been closed against the independents. He said he had for a year or more endeavored to open the door to the independents and he believed he would be successful in a short time. The Mayor said he once thought that to be cut off from the Bell or Cumberland Company meant to be cut off from the rest of the world. That delusion was quickly dissipated when he found the whole southern part of Indiana and contiguous neighboring states were a perfect network of independent lines, and that the instruments used by the independent people outnumbered those of the Bell or Cumberland Company by many thousands. "I also found," said he, "that service was furnished at a much lower rate than when the Bell enjoyed a monopoly and that in every instance the independent people were doing a profitable business at the rates charged."

The Mayor urged the independents of Southern Indiana to take up the fight in Evansville and help the independent movement along. Concentrated effort in this direction would, he believed, guarantee an independent local service in a short time.

The first paper on the programme was assigned to A. W. Funkhouser, city attorney for Evansville. Mr. Funkhouser said that by force of circumstances he was made somewhat familiar with the telephone conditions in Evansville. To give the people of the city and country a decent service at reasonable rates has been the sole purpose of the advocates of an independent company. Therefore, Evansville had concluded to go into the telephone business for herself. He declined to discuss the status of litigation between the city and the Cumberland Company for the reason that the matter is now in the hands of the courts, and a favorable decision was confidently expected in a short time. Mr. Funkhouser said there was not a single county in Indiana which has not independent telephone lines and exchanges and only two county seats in the entire State where the independents are not represented—Evansville and Booneville—the latter, however, having recently granted a franchise for an independent company. "There are at the present time in the State of Indiana," he continued, "134,000 independent telephones and about 40,000 Bell telephones—more than three to one in favor of the independents." He said it was a safe statement that nearly 40 per cent. of the farmers of Indiana are now connected by independent lines.

The evening session of the first day was given up to a banquet, and the visiting delegates were greatly pleased at the hospitality extended. After the cigars were passed speech-making began. E. W. Pickhardt, secretary of the convention, and George A. Cunningham talked on the Evansville situation.

The programme for the second day began with a paper by Vice-President Knoefel, on the "Independent Long-Distance Lines." The speaker pointed out the mistakes that had been made by the independents in the early history of the development and laid much of the blame for early failures to cheap construction. He said the proper construction of toll lines calls for 45 poles to the mile and No. 10 copper wire. He asserted that good service can only come as a result of good construction, and this can only be had at considerable expense at first, but would require much less expense to maintain in good order.

A. J. Payton, of Rockford, read a paper upon the "Bell People as Antagonists," which showed that he was familiar with every phase of the telephone fight. The following officers were elected: President, Charles D. Knoefel, New Albany; vice-president, L. G. Davis, Salem; secretary, E. W. Pickhardt, Huntingburg.

From the standpoint of interest and attendance the convention was the best ever held by the Independent Telephone Association of Southern Indiana. The delegates and visitors all expressed themselves as well pleased with the treatment they received from the Evansville people, and especially for the gracious manner in which the local committee made their stay in the city pleasant and profitable.

Wireless Fire Alarm Signalling Apparatus.

WIRELESS signalling apparatus lends itself admirably to a multiplicity of uses other than that of telegraphic communication, and just now it is being tested in Continental Europe relative to its value in the fire alarm service. M. Emile Guarini, prolific writer and inventor of divers devices appertaining to the emission, propagation and reception of electric waves, has conducted some interesting experiments in the transmission of wireless fire alarm signals; and he now proposes to equip the fire houses and numerous buildings of Brussels, Belgium, with this new type of apparatus.

The experimental instruments devised for this purpose are shown in the illustrations. Fig. 1 represents the transmitter photographically and the schematic arrangement upon which it is based in Fig. 2. As in an ordinary wireless telegraph system, an induction coil is employed to transform a low-potential direct current into a high-tension alternating current for charging the oscillator system. Additional apparatus is also provided for indicating the number of the burning building and its position and this is also shown in the diagram.

Referring to Fig. 2, 1 represents the tube of a thermometer; 2, mercury in the thermometer; 3 and 4, terminals of an internal circuit made of platinum and leading inside the thermometer tube; 5, a single dry cell; 6, an electromagnet operating an armature, 7; 8, a retractile spring; 9, a button forming a stop for the armature; 10, a disc having notches cut in its periphery at given distances apart,

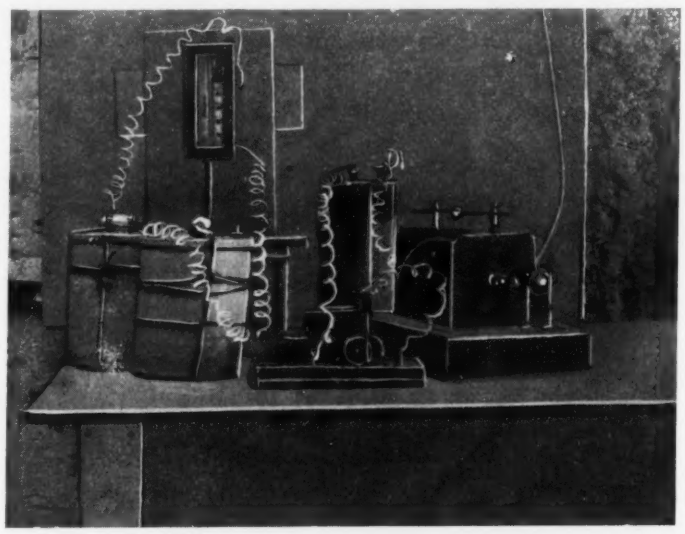


FIG. 1.—WIRELESS FIRE ALARM TRANSMITTER.

so that the exposed surfaces may represent the number and locality of the building; 11 is a spring contact making and breaking the primary circuit, which includes a battery, 12, and the induction coil, 13; 14 is the aerial wire radiating the waves; 15, the secondary of the induction coil; 16, the earthed terminal of the oscillator system; 17, an arrangement for automatically checking the disc after it has completed its revolution; 18, an insulated arc inserted in the disc to indicate that the number has been completed, and 19, the oscillator or spark-gap.

The receiver, Figs. 3 and 4, consists of an antenna, 20, connected with a coherer, 21, the opposite conductor plug leading to earth, 22, and a suitable receiving device, 23, operated by a battery, 24. This usually includes a relay, a tapper and a Morse register, as in a system of wireless telegraphy, although a single stroke bell may be used instead of the register.

This experimental equipment was placed in one end of the inventor's laboratory, where a miniature building had been erected, and at the opposite end of the room the receiver was placed in position as it would be in a fire engine house. After all these preliminary arrangements, the little building was fired.

When the heat emitted by the flames became sufficiently intense, the column of mercury began to rise in the capillary tubing of the thermometer and finally when it reached 42° Reaumur the liquid metal was forced into contact with the upper terminal, 3, and the internal circuit was closed after the manner produced by a thermostat.

The current now flowed through the circuit and energized the electromagnet, 6, and this action attracted the armature, 7, releasing the disc, 10, which revolved in virtue of its connection with a spring motor. The disc with its peripheral projections impinging upon the contact brush, 11, caused the current flowing in the primary circuit to be made and broken in accordance with the length of the actuated surfaces of metal representing numerals or letters as prearranged for indicating the number of the house and its locality.

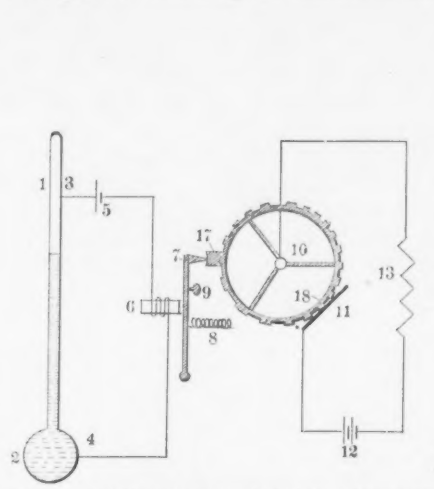


FIG. 2.—DIAGRAM OF SIGNALLING APPARATUS.

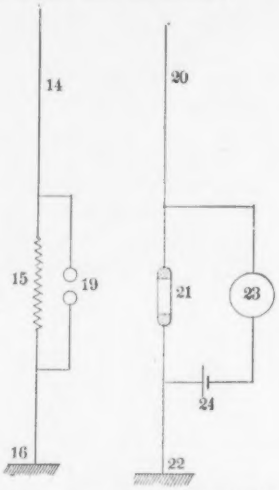


FIG. 3.—PRINCIPLE OF RECEIVING APPARATUS.

Since every disc may have any desired number of projections which may be of varying lengths, indicating dots and dashes, it is obvious that the combinations formed may be varied infinitely. This automatic device for making and breaking the primary circuit precludes the necessity of a manual key or an operator, although an arbitrary make-and-break may be interposed in the circuit and the regular Morse or Continental code transmitted.

When the current is interrupted by the disc, the impulses, which have a high time-constant compared with the automatic spring vibrator of the coil, set up alternating currents in the secondary coil, and this serves to energize the oscillator system, which in turn flashes out through space the important message notifying the firemen of the call to duty. The electric waves thus sent out impinge upon the aerial wire at the fire engine house, and these are converted into oscillations in the resonator circuit when the coherer is affected and actuates, in turn, the relay; the tapper and register respond to the fresh impulses and the latter prints on a tape the number and letter in less time than the horses can be hitched up and the engine manned.

At the first stroke a visible signal is indicated by a miniature incandescent light and the alarm is sounded by an electric gong. Guarini has worked out a scheme so that the first revolution of the disc gives a signal throughout the building on fire; and if the efforts

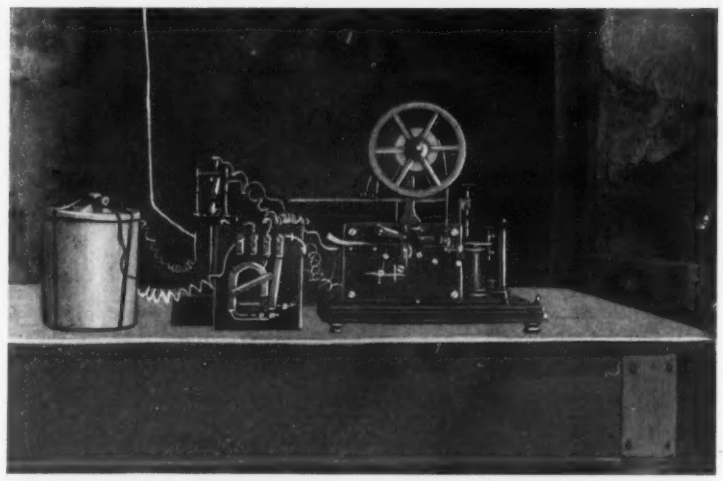


FIG. 4.—WIRELESS FIRE ALARM RECEIVER.

of the occupants are able to extinguish the flames in their incipiency no alarm is sent to the engine house.

In this system no central station is required, but the messages are transmitted directly to the engine houses. M. Guarini gives the credit of this idea to Signor Mollo, chief of the fire department of Naples, Italy, but has worked it out and put it into commercial shape, and a practical installation is now being set up in Brussels.

Recent Progress Abroad in Wireless Telephony.

Hardly had the general surprise at the discovery and far-reaching power of wireless telegraphy passed away when investigators and inventors began to strive for a solution of the problem of wireless telephony. Of course, this latter is a very different proposition from wireless telegraphy because of the necessity in the transmission of articulate sounds of preserving the wave form. In other words, the problem becomes not only one of transmitting a sufficient quantity of energy to affect the distant receiver; but in addition the component waves must be transmitted correct in all their instantaneous values. The inefficiency or weakness of our only present telephonic transmitting means would probably be an ever effective bar to the successful accomplishment of wireless telephony were it not for the extreme sensitiveness of the telephone receiver, the sensitiveness of this instrument being so great that it responds to the minutest variation of the electrical condition of its terminals. Therefore, if the

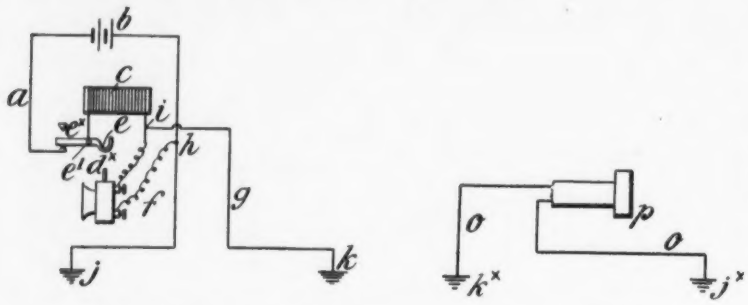


FIG. 1.—DIAGRAM OF SENDING AND RECEIVING CIRCUITS.

transmitter may be made by any combination of inductive coils to send out forced vibrations to the surrounding medium, a telephone receiver is pretty sure to catch them, provided it be within the radius of the final dissipation of the waves.

Experimenters soon found that with suitable arrangement of induction coil and transmitter, speech could be conveyed through the air, provided the receiving telephone was near at hand. However, if the discharge terminals be earthed, and both receiver terminals be earthed, then will the transmission take place over a considerable distance.

A still further improvement has been made by Messrs. James T. Armstrong and Axel Orling, of London, England, which enables the limits of wireless telephony to be extended. This improvement, already noted in our columns, is set forth in three American patents

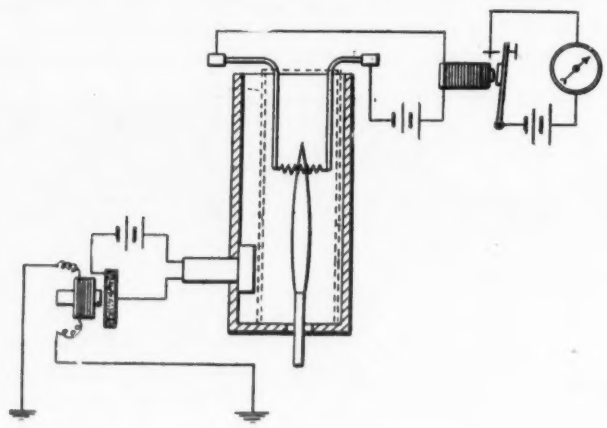


FIG. 2.—DIAGRAM OF CIRCUITS.

recently issued to these gentlemen, and, expressed in a few words, lies in "producing low-tension currents and high-potential discharges together." To this end the induction coil of other systems is replaced by a reactance coil connected with the transmitter, the battery and the earth in such a manner that the low-tension current waves directly due to the variation of the transmitter resistance, are supplemented by the simultaneous and powerful extra currents or inductive kick of the coil.

Fig. 1 shows the elementary transmitting and receiving circuits. It will be noted that the transmitter being in shunt with the ground portion of the circuit not only determines variations in the current traveling between the two grounds, *j* and *k*, but also causes variations in the current passing through coil *c*. For example, consider a sudden increase of the transmitter resistances. Simultaneously with this resistance change, an increased current from the battery will tend to pass through the earth, augmented by the inductive discharge of the coil, *c*, due to the diminution of current in it.

Now, experiment seems to show that the earth path for the current is not a direct line from ground *j* to ground *k*, but on the contrary the effect of the current variations is spread out over a large area almost as though electric ripples were sent out in all directions, these ripples being 180° apart in phase. Now, if a receiver be so grounded that the terminals are affected sufficiently and differently by the two ripples, then will the sound originally providing the ripples be heard in the receiver.

The inventors have not confined themselves exclusively to the field of telephony, but have devised an ingenious relay whereby sharp impulses of current may be received upon a telegraphic indicator or sounder. For such use the telephone transmitter is replaced by a telegraph key and condenser, while the telephone receiver becomes part of a receiver-microphone repeater affecting in its local circuit through a diaphragm chamber a sensitive flame. This flame when at normal length is in contact with a fine platinum wire, the hot resistance of which is sufficient to prevent the action of a relay or sounder in the circuit of which it is wired. When the flame becomes shortened from the action of the opposed diaphragm, according to its well-known property, the lessened resistance of the platinum wire consequent upon its being allowed to cool, permits sufficient current to flow to operate the sounder. Fig. 2 shows well the arrangement of circuit for such use of the system.

Meeting of Indiana Bell Telephone Officials.

The annual convention of the managers and superintendents of the Cumberland Telephone Company in the Evansville district was held at Evansville, Ind., November 11. Assistant General Manager Leland Hume presided over the meeting and said the convention was being held for the instruction and benefit of the telephone business in general, and the Evansville district in particular, and that those present would be called on to tell of the conditions existing in their exchanges and territory in a straightforward, truthful way. He said he supposed many present had been reading the electrical magazines, which generally, for selfish reasons, exploited the development of the so-called independent companies, and said very little in favor of the Bell companies. He said some of the electrical journals were barren of that necessary ingredient, truth; but in this meeting he expected the facts to be told as well as the truth in all of its wholesomeness.

An interesting paper prepared by Superintendent Powell, of New Orleans, La., was then read. Mr. Powell discussed the situation in Louisiana and Mississippi and cited numerous instances of the failure of the independent telephone companies in these States.

The reports of the managers were next heard and in each instance the communication was highly satisfactory as to development, service and profitableness.

Mr. Hume made the principal address at the evening session. He complimented the managers present on the interest taken and said it was exceedingly appropriate to hold this convention in Evansville, as it was the birthplace of the Cumberland Company. He asserted that there was not a town or a cross-road in the entire Evansville district that the Cumberland Company does not reach. He claimed that in Southern Indiana the Cumberland Company was operating 10,650 telephones, against 4,250 by the opposition, this statement being borne out by the tax records. He charged telephone promoters as being largely responsible for all the friction in Evansville. He said there were numerous independent plants in Southern Indiana for sale, and that their managers had repeatedly tried to sell their property to the Cumberland Company.

Mr. C. L. Meyers spoke upon the "Methods of Opposition," and showed that he was familiar with the arts of successful telephone warfare.

Each session of the convention was well attended and the proceedings were instructive. It is noteworthy in this connection that this convention was held at the same time and place as that of the Southern Independent Association, a report of which may be found on page 874.

Large Gas Engine Electrical Plant in Germany.

Great as is the interest at the present time in the steam turbine and its effect on the art, it may be safely said that the interest and importance of the gas engine are in every respect equal. If the steam turbine represents finality along its given line of thermodynamic development, then beyond the gas engine we may well look for glimpses of the gas turbine, but meanwhile the gas engine appears to have barely entered upon its career of possible development and utilization.

We have already from time to time called attention to and illustrated various gas engine electrical generating plants in this country and abroad, and are now able to note a very interesting and extensive plant of this nature in Germany.

The accompanying illustration, Fig. 1, shows the interior of the power plant of the mining and steel works at Gross-Ilsede, near Peine, Hanover. In this power house there are two units of 1,000 hp each directly connected to three-phase alternating-current generators which supply current for light and power. There are also at these works two blowing engines operated by waste blast furnace gases each having a capacity of 500 hp. These large gas engines are of the Oechelhaeuser type and were installed at the Bergbau und Hüttengesellschaft Ilseder Hütte by the Kölnische Maschinenbau-Actiengesellschaft of Köln-Bayenthal, Germany. Only one of the 1,000-hp units is shown in the illustration. The engines are of the double type, the revolving field of the generator acting as a fly-wheel and is located between the two sets of cylinders.

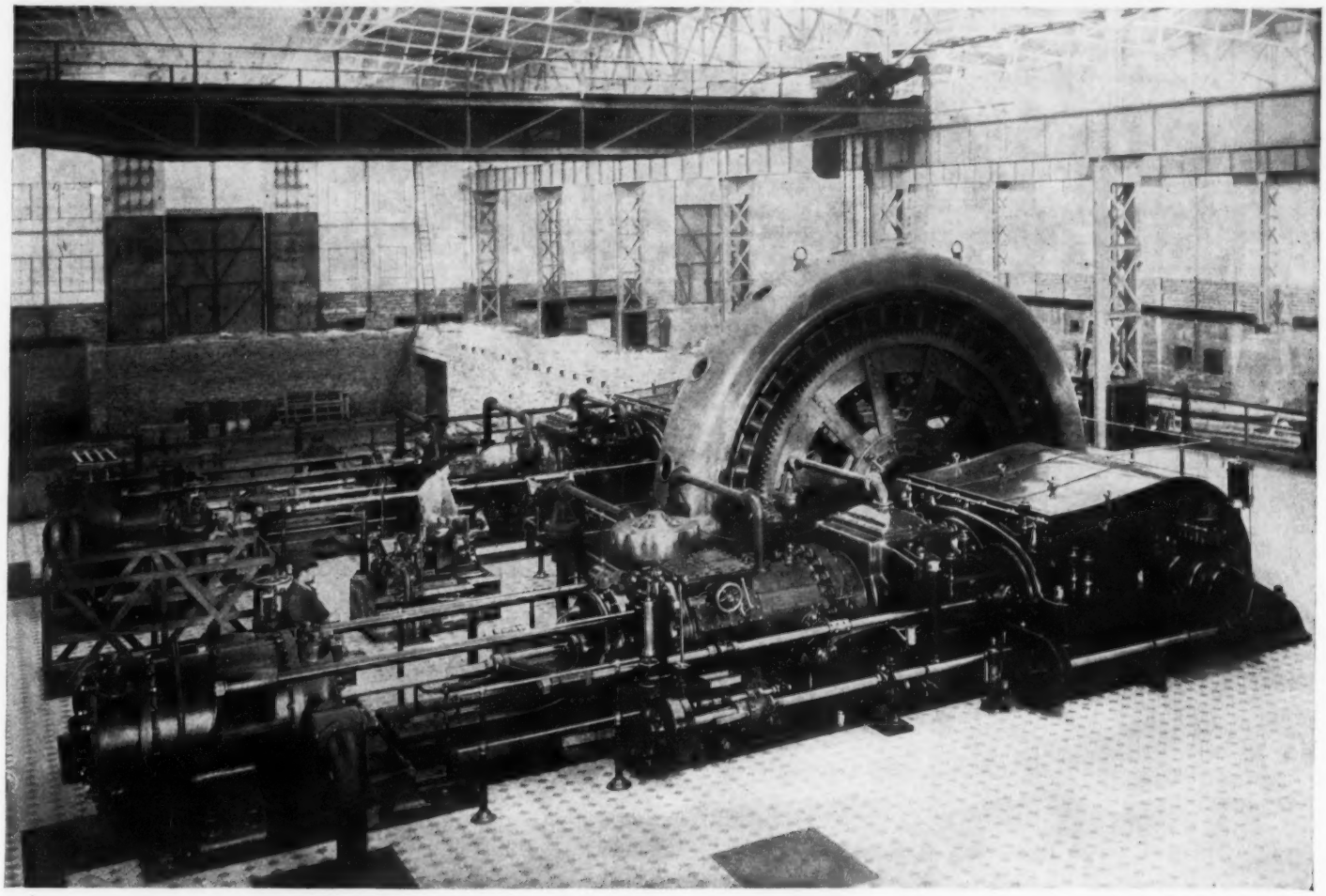


FIG. 1.—INTERIOR VIEW OF PLANT, SHOWING 1000-HP GAS ENGINE.

The accompanying drawings, Figs. 2 and 3, indicate the principle of working of the Oechelhaeuser gas engine and show the details of construction of a single engine and of a 500-hp Oechelhaeuser gas engine and generator at the works of the Deutsche Kraftgas Gesellschaft, of Berlin. This engine is constructed on the principle of a symmetrical arrangement of two plunger pistons working towards each other, each a simple cylinder which is open at both ends. These pistons shortly before reaching their dead points open successively the different ports, including the exhaust port, the port for rinsing the cylinder by fresh air and the gas inlet.

Such a large quantity of burned gases escape at first that the pressure in the cylinder sinks as low as the atmosphere; then the fresh air which enters blows out the rest of these gases through the exhaust pipe. A yielding cushion is thus formed between the hot exhaust gases and the fresh gas before the fresh supply enters and mixes with the air entering, forming with the latter the explosive mixture. The two pistons nearing each other then compress this mixture and it is ignited for explosion shortly before the end of the compression, thus driving the pistons from each other; and the operation is repeated, indefinitely.

In this engine the air and gas are supplied by a feed pump and are compressed in the receivers arranged around the inlet ports to such an extent that a sufficient rinsing of the cylinder is effected as well as a good mixing of the air and fresh gas. The number of revolutions of the engine and the power can be regulated in the same manner as is done with steam engines by means of a throttle valve. In this case the supply is regulated to the pump by a simple admission valve. It will thus be plainly seen that the cylinder itself has no valve operating during the piston stroke and the engine is thus greatly simplified.

It will be noted that the working cylinder is arranged in its horizontal line in such a manner that it may extend freely without any alteration to that of the blowing cylinder. The working cylinder is fastened in the cooling mantle in such a way that its free expanding by the heat is secured, the cooling spaces also being brought close to the receivers for air and gas. The middle crosshead pin is not inside the working piston, but in a crosshead brought outside, which glides in a circular guide; and this pin is thus shielded from getting heated and is also accessible when desired.

Under the flooring the feed pump is arranged so that its piston feeds with the underside for the air and the upper one for the gas to the cylinder. The blowing cylinder is fastened to the end of the framing and draws in the cold air from the outside. The

engine is started by compressed air stored in a receiver which is located under the flooring, and this is supplied by an electrically-driven pump, the electric motor for this outfit also serving to turn the engine into starting position. The gases are exploded by electric ignition.

A blowing engine of 800-hp capacity has a working cylinder 30½ in. in diameter and a blowing cylinder 72½ in. in diameter, while

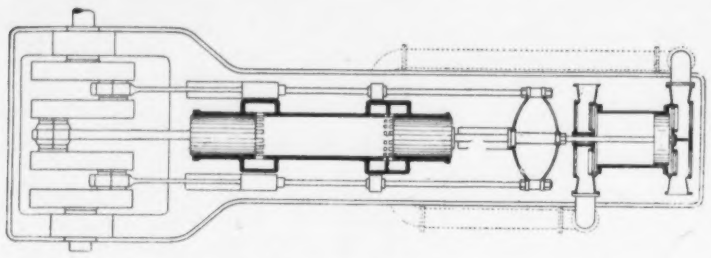


FIG. 2.—DIAGRAM SHOWING PRINCIPLE OF GAS ENGINE.

the stroke measures 37⅜ in. in length. Such an engine is capable of compressing 17,662 cu. ft. of air per minute to a pressure of 7.7 pounds per square inch when working at a speed of 100 r.p.m.

At the power house of the Südrussische Metallurgische Gesellschaft in Kamenskoje, Russia, there are three such 500-hp electrical gas engine units, and there are three 600-hp electrical units of this

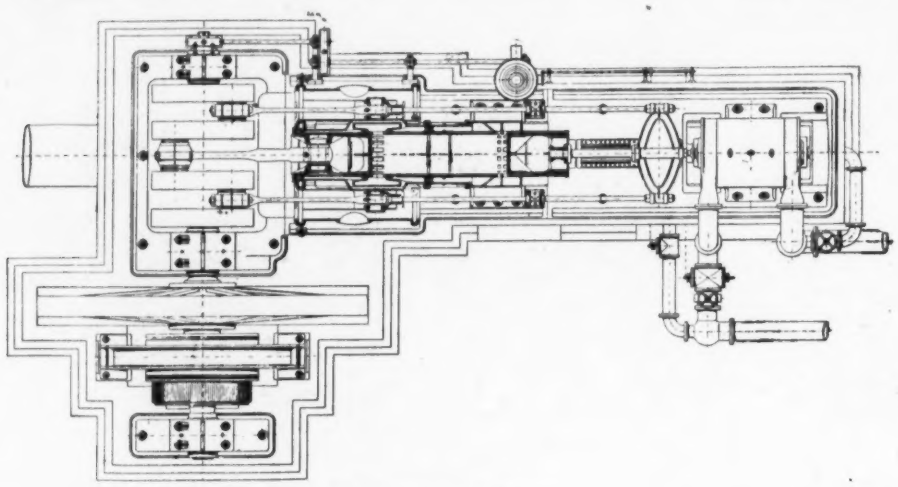


FIG. 3.—DIAGRAM OF 500-HP GAS ENGINE.

type at the Hörder Bergwerks und Hüttenverein at Hörde, Germany. Waste blast furnace gases, it is said, supply 1,000 hp for every 100 tons of pig iron produced when properly utilized in modern gas engines of large capacity.

New York Electrical Society.

The 238th meeting of the Society will be held at the Hebrew Technical Institute, 34 Stuyvesant Street, Monday, November 30, at 8 p. m. Mr. W. D'A. Ryan will lecture on "Practical Problems in Lighting and Illumination." The lecture will comprise the most effective use of the various standard methods of lighting, arc, Nernst, incandescent, Welsbach and hydrocarbon, and their values and respective places in successful commercial illumination. The lighting of various kinds of mills, machine shops, iron foundries, ship sheds, the interior of steel ships under construction, stores and advertising displays will be exhaustively considered, and figures will be given for the most efficient illumination in different classes of work. The quality of diffusion will be specially commented on. For the purposes of illustration the stereopticon and blackboard will be supplemented by the use of a very elaborate collection of instruments, giving various phenomena of light waves, photometric light curves and interior illuminating effects, and introducing general engineering data. Owing to the variety of effects and current required, Secretary Guy had some difficulty as to an appropriate meeting place, but on inquiry it was found that the well-equipped Hebrew Technical Institute was fully adequate to the occasion; and thus it was arranged to hold the meeting there this time on the courteous invitation of the officers and technical staff.

Single Phase Motors for Traction.

A recent article by Finzi in the London *Electrical Review* on the use of single-phase motors for traction should be interesting, since its author has recently been reported to have made successful trials with single-phase traction in Milan on general lines somewhat similar to the method of Lamme, of the Westinghouse Company. The author believes that polyphase induction motors are unsuitable for traction work. While they are easy to build for high tension, they cannot well or economically work beyond narrow limits of speed, and three conductors for the current (or two if the rails are used for one), present an almost prohibitive difficulty. While this statement might appear to be too sweeping in view of the success of the Valtellina Railway, yet fitness of a system for a given industrial object, far from being proven by the success of any single plant, requires the extending of its application after the initial experiments. From this point of view, three-phase traction rather appears as a *tour de force* little inviting repetition.

Single-phase induction motors are only satisfactory near synchronous speed, so that small industrial plants at a constant speed remain the only appropriate field. Mr. Finzi believes that the ideal case for electric traction is represented by the series motor with a variable voltage supply. Variable voltage can be obtained by very simple means in the case of single-phase alternating currents and only one trolley line is required with a rail as return. There is no objection to high-voltage supply since the voltage can be lowered by transformers on the train. The present single-phase traction motor of the author is the development of ideas formerly embodied in the marine type of the continuous-current motor of the Brioschi Finzi Company. Its characteristics are a laminated multipolar field core with longitudinally-divided poles, a small air-gap, low speed and a set of resistances connecting the armature windings to the commutator segments. The longitudinal division of the poles is believed to be fully as important as the laminating of the field, since it forms the simplest means to kill the reaction flux of the armature. Another less satisfactory system is to saturate highly the portion of the poles near the air-gap, which is accomplished in the Lamme single-phase motor through a number of holes in the poles. In this case the hysteresis loss is higher. Another system is to place short-circuited windings in the poles, or to use a symmetrically-distributed field winding supplied from opposite points and short-circuited at 90° from the points of supply. These subsidiary means again dissipate some energy, and leakage prevents them from attaining their end completely. Though the transverse flux is done away with, a greater difficulty remains; that is the sparking due to the short-circuiting (under the brushes) of the armature sections as secondaries of a transformer under the influence of the alternating-current-fed field poles.

The author says that his old direct-current marine motor already carried the best remedy that he knows to-day, i. e., the German silver resistances connecting the windings to the commutator enter each in its turn into their convenient short-circuit, so that the maximum current following is brought down to a lower figure. With a design giving a low-reactance voltage in the armature sections, and with an appropriate shape of the poles, this remedy allows good series motors to be designed for traction use, for frequencies of 15 to 20 or more, and for 100 to about 300 volts. The author discusses some objections which were recently made by Latour against the series alternating-current motor in general. He emphasizes that at the trials of his single-phase motor in Milan commutation was satisfactory at all speeds. Runs on the same conditions with direct current on a General Electric 52 motor did not show a better behavior at the brushes and the commutator of his motor did not require the smallest care through all the experiments. He points out that this result was obtained without any roundabout devices, simply by adequate design and the use of a suitable shape of the magnetic circuit and with the aid of those resistances between winding and commutator. While these resistances are in the single-phase motor higher than usual in direct-current machines, their presence does not appreciably lower the efficiency, because at a given moment the

whole current either passes through two of them only or through two pairs of them. To have killed the transverse reaction simply by dividing the magnetic circuit—not through special windings or by short-circuiting the main stator winding in symmetrical points—does away with an ohmic loss and a non-symmetrical heating. His motor is said to have shown a power factor of 0.85 to 0.98 through a range of speed and voltage of 550 to 1,400 revolutions, and with 80 to 160 volts with the torque necessary for the equipment used. The author gives some criticisms of the Latour motor and then discusses the single-phase motor of the Wagner Company and its recent improvement by Schueler. The Wagner motor has a stator with a single-phase distributed winding, and a repulsion rotor with a short-circuiting brush-lifting automatic device that turns the system into a pure induction motor when the starting has been accomplished. The Schueler motor is based on the same principle, but the repulsion and the induction, instead of being clearly defined, cover each other mutually from the starting point to full speed, the only difference being in the moving part, which is an ordinary rotary converter rotor, with a three-phase starting rheostat connected to the slip rings and short-circuited brushes on the commutator side. Thus the commutator makes it a repulsion motor, less and less active from starting to full speed, while the rheostat makes it an induction motor, more and more active from rest to full speed. The voltage control in starting is deficient and requires complications in practice. The series single-phase motor at a constant voltage regulates its speed according to the load put on, the speed at high loads being inversely proportional to the load; it allows a voltage control without losses and with the widest speed limits. As against these advantages it cannot use high voltage directly and it is for the present bound to comparatively low frequency; but the voltage controller can be combined with the transformer and the other feature is only an obstacle when the use for traction of ordinary light and power plants is considered.

Recent Electrochemical Developments.

OZONIZER.

In these columns we noticed recently an improved form of the ozonizer and water sterilization apparatus, devised by Dr. Marius Otto, of Paris, France, who has been working in this line for a number of years. A patent granted to him on November 17 relates to an apparatus for providing small quantities of ozone from currents of low periodicity (not more than 100 periods per second). Such low-frequency currents, after having been raised in the transformer to several thousand volts, operate the ozonizer shown in the adjoining diagrams which give a vertical and horizontal section of the apparatus. A metallic cylinder, *a*, is divided into parts by vertical cuts and revolves around an axis. This cylinder communicates with one of the poles of the high-tension transformer. A thin glass tube, *b*, is covered on the outside with a metallic conducting layer, *e*, which is also divided into portions by vertical cuts and communicates with the second pole of the high-tension transformer. The air which is to be ozonized is drawn in by a ventilator through the orifices, *o*, and follows the course indicated by the arrows. The electric discharge leaps across annular space between *a* and *c*.

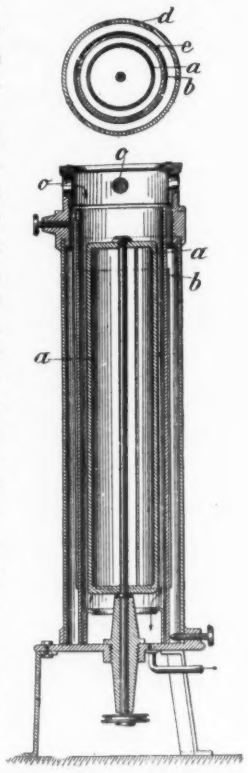


DIAGRAM OF OZONIZER.

SEPARATING OILY EMULSIONS FROM WATER.

The condensed water from steam engines contains oil in two forms, viz.: partly emulsified and partly free. Before it enters the steam boiler as feed water, the oil must be removed. The free oil particles are filtered off by ordinary filters, but the emulsified parts pass through any filter unchanged. For removing the same, the following electric method has been devised by Messrs. H. T. Davis and E. Perrett, of Lewisham, England. To improve the conductivity of the water which has to undergo the electric treatment, a small quantity of ordinary clean water or of a soda or potash solution is added to the emulsion. The water is then let into a vessel fitted with a number of suitable electrodes so arranged that the water is thoroughly stirred up. The current passing through the water has the effect that "the infinitely minute oily particles in emulsive condition are freed or let loose and unite simultaneously with infinitely small iron particles which separate from the electrodes." They are then in a condition to be easily removed by ordinary filtration.

ELECTROPLATING.

A patent granted to Mr. A. Darlay, of Paris, France, relates to a process for electroplating metallic objects without the use of an external source of current. The object to be plated is brought into contact with metallic aluminum containing a salt of the metal to be deposited. This arrangement acts as a short-circuited cell in which the aluminum is the anode and is corroded, while the metallic object is the cathode and receives the desired coating. He uses a solution of a chloride, cyanide or other compound of the metal to be deposited, containing ammonium chloride and an alkali, an alkaline phosphate or pyrophosphate, or an alkali metal cyanide. The continuous attack of the aluminum surface is assured by the alkaline character of the solution. The ammonium compound serves to improve the conductivity of the solution.

ELECTRIC BATTERY.

A patent granted on November 17 to Messrs. J. A. Lyons and E. C. Broadwell, Chicago, Ill., refers to a somewhat peculiar type of accumulator. If the chloride, bromide or iodide of lead, nickel, zinc, etc., is electrolyzed with a porous carbon anode, the metal is deposited upon the cathode, and the chlorine, bromine or iodine is absorbed by the porous anode. This porous carbon plate is either made by cementing it together in such a way as to leave it very porous throughout, or by filling granular carbonaceous material into a suitable retaining wall of cloth asbestos. Such a porous carbon electrode is stated to be able to condense and retain within its pores about 200 times its volume or three-fourths of its weight of chlorine gas and a larger quantity of liquid bromine. In this condition the cell is in the charged state. When discharging, the metal is dissolved from the other electrode, and the chlorine or bromine goes back into solution from the carbon plate, so that the original chloride or bromide is formed back.

MISCELLANEOUS.

In recording electric meters the change of friction between the commutator and the brushes during use may become a serious matter. In a patent granted on November 17 to Mr. C. H. Ingalls, of Danvers, Mass., and assigned to the General Electric Company, a method of treating the surface of the commutator and the brushes is described which prevents a change of the friction during use. The inventor applies to the surfaces in question a solution of a sulphide or polysulphide, which will act on the metallic surface in such a way that it will not thereafter be changed by the action of the atmosphere. Furthermore, so far as the commutator and brushes enter into the proper running of the meter, their condition will remain stable, and the accuracy of the meter, particularly on small loads of 5 per cent and beyond the rated capacity of the meter, will be found more reliable than with meters in which the commutator and brushes have not been thus treated.

A patent granted on November 17 to Mr. H. Campbell, of Melrose, Mass., refers to mechanical details of a magnet designed for use in connection with apparatus for the magnetic separation of ores.

German Telephony.

A cable dispatch from Berlin of November 20 to the newspaper press says: "Naval designer Zopke reported exhaustively on the uses of the telephone at sea before the Shipbuilding Technical Society recently and exhibited a new stentorian microphone, whereby a commander is able to give audible commands to the crews of six guns simultaneously. The instrument at the same instant is susceptible to the faintest sounds, and experiments are being made in the detection of the approach of ships not yet visible, by placing the instrument under the water. Designer Zopke also gave a demonstration of new fortification instruments, notably a call apparatus, which is as loud as a trumpet. The audience displayed special interest in explanations of Elisha Gray's telautograph and in the wireless telephone experiments of Prof. Simon, of Göttingen."

New Telephone Patents.

SELF-RESTORING PROTECTORS.

Recently a great deal of ingenuity has been displayed in the design of "sneak-current" devices, which do not become permanently injured when operating to open or ground the circuit, but which on the contrary use the very heating in response to which they operate to reset the device for future operation. The latest type of such device is shown in Fig. 1. The detailed design is best seen in the sectional view. This is a horizontal section, and shows within a closed chamber a thermal device such as a carbon rod, which forms part of the circuit to be protected. One end of this rod extends to a metal button, while the other connects with two extension plates between which is soldered a U of sheet metal. The ends of the legs of the U are flared to engage normally the corresponding line spring, which spring tends naturally to pull away from the cut-out. When such a current passes that the heating of the graphite rod melts the solder the legs of the U momentarily deflect and release the line terminal to open the circuit, and then, assuming their normal positions become resoldered as the device cools. Mr. Otto Hoffman, of Chicago, is the inventor of this protector.

A second protector recently patented is of the open space type and is designed for use at subscribers' stations. This is the invention of

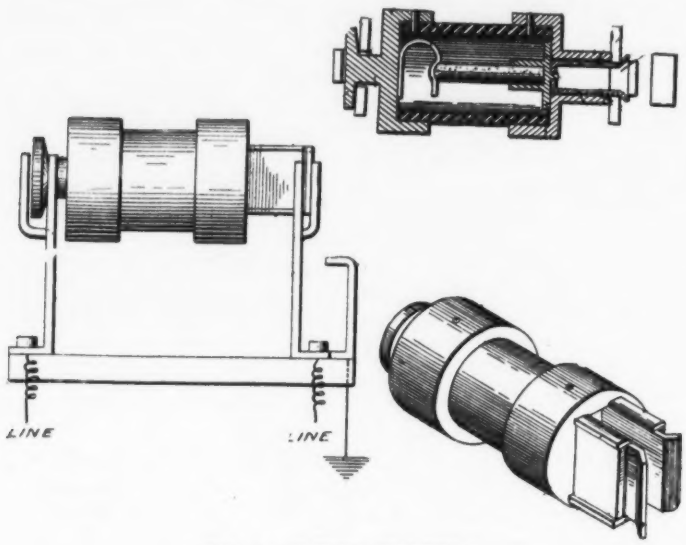


FIG. 1.—CIRCUIT PROTECTOR.

W. L. Ralston, of Westchester, Iowa, and consists of a pair of carbon blocks and mica separator upon a new and suitable mounting.

ANTISEPTIC DEVICES.

Two more antiseptic devices have made their appearance as the subjects of patents granted respectively to Messrs. W. Griffin, S. Sanker and B. Keith, of Riverside, Cal., and to H. L. Cutter, of Los Angeles. The device of the latter is a suitable mounting carrying a roll of paper adapted to be gradually drawn across the mouthpiece as desired. The paper already having done service is stored in a roll about a spindle which serves as the driving mechanism.

The other device consists of a metal extension for the mouthpiece, which contains an annular chamber in which may be placed wicking soaked in antiseptic solution. The communication between the mouthpiece and annular chamber is a series of small apertures adapted to be closed if so desired by a slight turn of the mouthpiece.

SELF-RESTORING, INTERCOMMUNICATING SWITCH SYSTEM.

Messrs. T. J. Seely and C. Hemsing have devised a self-restoring, intercommunicating switch wherein the individual line switch members on being depressed to their fullest extent engage a ringing busbar. On being released, a tilting bar acting at once as a latch and as a telephone contact, restrains a returning line spring until the rocking bar is tilted either by the depression of a second line spring or by the return of the receiver to the hook-switch.

SIGNALING A MOVING TRAIN.

Another recent patent covers a system of signaling moving trains. In this system a series of short conductors, all wired to the same line wire, are arranged upon poles at suitable intervals along the track. Each locomotive carries a contact adapted to engage the distributed contacts. When it is desired to signal a train the operator, through a switchboard, puts grounded battery upon the line so that as soon as the locomotive makes a passing contact with it an electromagnetic device will cause the sounding of a whistle in the cab. The engineer will then bring his train to a stop at the next stationary contact and with a telephone outfit, of which the signaling device forms a part, call up and ask for orders. Messrs. J. A. Whyte and G. C. Edwards, of Toronto, Canada, are the joint patentees of this system.

New York Meeting of the A. I. E. E.

The monthly meeting of the American Institute of Electrical Engineers was held on November 20 at the Carnegie Music Hall, New York City, when two papers were presented, one on "The Electrical Conductivity of Commercial Copper," by Mr. Lawrence Addicks, and the other on "The Comparative Behavior of Floating and Booster-Controlled Batteries on Fluctuating Load," by Mr. Lamar Lyndon.

In the paper by Mr. Addicks, consideration was first given to the influence of chemical impurities on conductivity, and the physical characteristics were next taken up. Diagrams showed the relation between arsenic or antimony and conductivity, and between suboxide and conductivity in annealed wire. In regard to physical characteristics, Mr. Addicks discussed wire drawing, or the variation of conductivity with hardness, the effect of temperature in the annealing operation, etc., and curves also illustrated these points; although the conclusions to be formed were not very clearly brought out. Half-tones were shown of microphotographs of samples of good cast copper, as well as of "burned" trolley wire. The author remarked: "In cast copper we have a conductivity resulting from the combined conductivities of the pure copper grains and the impure matrix or cement. When this is rolled the structure is broken down and the complex shunt and series circuits are rearranged to better advantage. When hard-drawn, the molecular freedom is restrained and more work has to be done in the necessary oscillation of an atom in passing a charge on to its neighbor. In annealing, the wire is brought to a temperature at which the cement is softened and all internal strain is equalized. In burning, crystalline growth is started and reverts the metal to the original condition."

In discussing this paper, Mr. F. J. Newbury, of Trenton, said: "In regard to specifications for copper I had, about two hours before I came here, a question submitted to me by an engineer who wished to use copper strands for conducting currents of high tension, and he was trying to get some specifications that would apply to such copper strands. He wanted 00 copper strand. He wished to make up his specifications based upon the resistance per mile to the strength of that strand. I took the position that I would be pleased to make his specifications based upon the character of the individual wires of the strand—if such wires are hard drawn they have a strength of about 60,000 pounds per square inch, and should have a conductivity of 97 per cent., according to Matthiessen's standard. But when you strand them the resistance of the strand is not the same as the resistance of a copper wire of equal weight per foot—the resistance of such a strand is increased by about 3 per cent., apparently about the amount taken up in the twist. In other words, the measured current seems to follow the individual wires instead of passing freely along a line parallel to the axis of the strand, so that when you specify the resistance of the strand you are getting into a very uncertain thing, depending on the lay of the wires as well as on the conductivity. In the same way, when you go into the strength of the strand, you are getting into something that is very uncertain. The strength of the strand will be about 90 per cent. of the strength of the individual wires composing it. In a great many cases in specifications we find as manufacturers that this matter is true, that people specify the properties belonging to the strand when we believe it would be much better and simpler for them to specify the properties belonging to the individual wires composing the strand. The instruments now available for measuring the conductivity of copper wires take lengths of two to three feet and measure within one-tenth of one per cent. The testing of the strength of individual copper wires is a very easy thing, and so along that line of specifications it seems to me that the only way for you, as engineers, to specify is to specify the strength and conductivity of individual wires, and this applies, of course, most strongly to the

strength. I think that is possibly all I can say to you in this respect, except that commercial copper as it runs these days comes very close to 100 per cent. conductivity, according to the tables published by this Institute, and that in strength it varies from 52,000 to about 65,000 pounds to the square inch, depending upon the reduction in drawing; 68,000 pounds is the maximum that can be gotten out of copper wire and is only done by careful manipulation; 60,000 pounds to the square inch, for ordinary masses, is a very fair specification to make."

Mr. Lyndon's paper may be said to have dealt with a specific case of battery use, as indicated by its title, or one set of conditions, involving also the use of the battery, or its function, in the station as different from its function on the line; as for example, in relieving the strain on the generators under fluctuating loads. The paper was very elaborately illustrated with curves and was an excellent treatment of its topic, occupying some 32 pages of printed matter and diagrams, to which the reader may be referred.

The discussion was rambling, but quite interesting. Mr. J. R. Appleton spoke of a recent instance in Oakland, Cal., where they have recently built a railroad in connection with a new ferry line in San Francisco. They run three and four-car trains, and there are periods during each hour when the load is entirely off the station. The station equipment is one 600-kw, and one 850-kw generator, both direct-connected to Corliss type low-speed engines. Before the battery was in operation it was absolutely necessary to have a man at the throttle of each engine to regulate the engine when the load went off the station entirely. Now, with the battery in, the 850-kw generator maintains a load between 700 and 800 amp. all the time, with swings up to 2,600 amp. on the station. This practically maintains the load absolutely constant on the generator, no strain at all, and leaves the 600-kw generator as a spare. That was a good example of what the battery would do under those conditions.

Mr. Hubbard remarked that the proper thing to do is to design the battery in such a way that should the entire load go off the station the battery will still continue to charge. Mr. J. L. Woodbridge emphasized the difference between the function performed by the battery at the station and that performed by the battery on the line. "These two are so widely different it is almost impossible to get the results from a station battery that you want on the line, and you will not get from the line battery the results you desire to get from the station battery. If you want both results it is almost absolutely necessary to put in both installations. The station battery will steady the load on the plant, but will not give you any improvement on the voltage on the circuit any distance from the power plant. On the other hand, the battery out on the line usually regulates so small a portion of the load, being connected with one of the feeders, it has a very small effect in regulating the load on the station—usually a very small section of the whole system is controlled by the battery that is floating on the line, so that the only purpose of installing a battery at a distance from the power house is to maintain voltage at that point near its average, and prevent it from going to the low minimum voltage which occurs sometimes without a separate insulation."

Prof. Goldsborough, Mr. C. Blizard and Mr. J. W. Lieb also discussed the paper in general terms, the latter laying stress at some length on a point rather outside the topic, but still important, namely, batteries in central stations, and floating on the system in parallel with the exciter sets to insure constancy of field excitation. Mr. W. W. Donaldson took up a pithy phrase of Prof. Goldsborough as to "efficiency of equalization," and said: "There is one question which Prof. Goldsborough, in speaking of what he terms 'efficiency of equalization,' has suggested to my mind, and that is what I call the 'diurnal activity' of a storage battery on fluctuating railway loads. Taking the kilowatt capacity of a battery at the one-hour rate of discharge as a basis, a wattmeter placed in the battery circuit and controlled by a polarized relay, so that only the discharge will be recorded, will show at the end of the day what work has been accomplished by the battery, or its 'diurnal activity.' This record will not be a direct indication of the efficiency of regulation, but will show positively the extent to which the capacity of the battery has been utilized. In a paper which Prof. Goldsborough read before the Institute meeting at Niagara last spring, and which embodied the results of tests on the sub-station batteries of a Western road, he gives figures from which may be calculated the "diurnal activity." On five sub-stations this varied from .85 of one to two—or in other words, the battery which did the least work, showed an output of only 85 per cent. of its capacity at the one-hour rate during a day's run, and the best showed that it was discharged twice during the same period. Prof. Goldsborough said there was evidently 'something doing' in the latter case. To my mind, a battery properly proportioned to the load and with an efficient booster, should do much more than was shown by any of the plants alluded to. The more work you can do with a battery above zero, the more you are getting for your money. If a battery discharges up to its hour capacity once a day, it is doing a certain amount of work, but if it discharges three or four times a day it is doing proportionately much greater work. This question of "diurnal activity" has not been given the attention it should receive."

As to the use of batteries in central station, Prof. Goldsborough told the following story: "Mr. Lieb very justly mentions the importance of the storage battery in connection with large communities relying upon a central generating plant for service. That point was very strongly brought out in connection with an occurrence in Chicago which involved the exhibition of a considerable amount of nerve on the part of the president of the Chicago Edison Company, Mr. Insull. It occurred this way: Before the Chicago Edison Company installed a very large storage battery in the downtown section, and when they depended very largely on the Harrison Street station for serving that district, something got wrong with the pumps in the Harrison Street station one night. The force there handled the situation as best they could and made every endeavor to get the pumps back in motion to start water into the boilers again. They lost control of the plant and the water got so low in the boilers they became alarmed and pulled the switches, and all that portion of the city was in darkness. Mr. Insull happened to be in a theatre downtown, and, groping his way out, made for the Harrison Street station. He got his men to work with lanterns, and they finally got the pumps in such condition that water again began to flow into the boilers and things were ready to start up. The question came up of starting that great system, when Mr. Insull knew that every light in the city was turned on. After the engines were started they got the switches arranged in the proper position for quickly throwing them in. All the attendants at the station went outside and Mr. Insull took a long bar, and when he got himself properly poised, with one motion he threw every switch in and put every generator into parallel. The generators fortunately took the load and nothing happened. I think any one of us would appreciate that that was a moment when it required considerable nerve to start the machinery. With a storage battery that thing could not have occurred. If the Harrison Street station shut down to-night, the storage battery would take care of the load without trouble. That is exactly what the storage battery means. We know that we must have our stations equipped so that such a thing as having a great city in darkness cannot occur."

CURRENT NEWS AND NOTES.

LAMME SINGLE-PHASE RAILWAY SYSTEM.—A car equipped on the Lamme single-phase railway system has been in experimental operation for some time on a short line of track at East Pittsburg with excellent results. One of the noticeable features of operation is the smoothness of acceleration, there not being the slightest inconvenience to passengers in attaining a rate of 1½ m.p.h. per second, or in slowing down at a corresponding rate. But a faint trace of sparking is evident at the brushes at any speed. Owing to the shortness of the line, the highest speed at which the car is exhibited is 45 miles per hour; but it is capable of a speed of 60 miles per hour. The line voltage is 1,200.

A. S. M. E. MEETING.—The American Society of Mechanical Engineers will hold its forty-eighth annual meeting in New York City December 1-4. President J. M. Dodge will deliver an address on "The Money Value of Technical Training." Among papers to be presented are the following: Prof. J. E. Sweet, "What Are the new Machine Tools to Be?"; Mr. F. A. Scheffler, "Suggestions for Shop Construction"; Mr. F. B. Perry, "Method of Determining Rates and Prices of Electric Power"; Mr. L. A. Gillet, "Three and Four-Wire Multiple Voltage Systems"; Prof. D. S. Jacobus, "Test of a Compound Engine Using Superheated Steam." A number of trips and visits to electric power plants are included in the programme, as well as a conversazione at Sherry's on December 3.

MUNICIPAL OWNERSHIP.—There is apparently a strong reaction in England against the idea that the State or the municipality must do everything. An evidence of this is the fact that E. P. Dutton & Co. are publishing this week a book entitled "Municipal Trade: The Disadvantages Resulting from the Substitution of Representative Bodies for Private Proprietors in the Management of Industrial Undertakings," by Major Leonard Darwin, author of "Bimetallism." This work is historical as well as critical.

VIENNA MOTORMEN'S OATH.—The following is, according to the *London Morning Advertiser,* the text of the oath administered to men who accept service on the Vienna municipal tram cars: "I swear on my word of honor to be faithful and obedient to His Majesty, Imperial, Royal and Apostolic, Francis Joseph I., as well as to the successors of the eminent house of Hapsburg-Lorraine, and to contribute with all my strength to the honor and profit of the city of Vienna. I further swear on my word of honor that I do not belong, or will belong, to any party which pursues republican tendencies, or to the enemies of Austria." Where does the public welfare come in under this arrangement? Here it is Parks instead of Francis Joseph.

REFLECTOR INCANDESCENT LAMP.—Mr. Clarence A. Crane, of Warren, Ohio, has patented an incandescent lamp with a reflector built into the cap end, with the idea of converting the usually hidden, or dark space, into an illuminating and radiating area, as is already done with various styles. In making this lamp he introduces the tubing from which the reflector is spun, before inserting the glass stem and filament, and spins the reflector within the bulb to fit the sides, which can be easily and quickly done with a proper expanding spinning tool. The lamp is then completed in the usual way. To offset any tendency of the reflector to work down by loosening, a small quantity of cement within the neck will hold it in place. In another form of this lamp the reflector is affixed directly to the entering stem holding the filament ends and is split on radial lines, so as to be compressible for introduction through the neck of the bulb. On account of its springiness, it spreads out to its proper position and holds a reflecting position over the filament. In yet another form it is split lengthwise so as to secure compressibility for entering the neck of the bulb.

SUBMARINE SIGNALING.—We have already illustrated and described in these pages the work of Dr. Elisha Gray and his associates in connection with the electrical ringing of bells for submarine signaling. A patent has just been issued to him on the subject, for which the application was filed in 1900, and which is assigned to the Submarine Signal Company, of Boston. Hitherto all attempts at ringing submerged bells by the direct blow of an electrically-actuated hammer have been undertaken by enclosing the whole apparatus in an air-tight chamber so that the vibrations of the bell were deadened and very few of the impulses were conveyed into the water. As our articles have already explained, in the Gray system the bell and bell hammer are divested of coverings of this character and are submerged directly in the water; while the electrical operating mechanism for actuating the hammer is contained in an air-tight chamber placed above the bell, but which may also be submerged. This bell can, of course, be controlled from a distance and the bell hammer may be of considerable size and power, giving "great initial sound-producing capacity for long-distance submarine wireless telephony."

RAILWAY MORTOR CONSTRUCTION.—A patent issued to Mr. George Macloskie, of Schenectady, and assigned to the General Electric Company, deals with the construction of street railway motors. As built hitherto the armature core laminæ have consisted of flat discs. As a consequence, there has been considerable lost space between one end of the core and the commutator; while at the other end of the core the space has been overcrowded. Hence, the journal bearing at the pinioned end of the armature has been so restricted in length as to heat very easily, while the ventilating air passages were throttled, so that the efficiency of the motor has been lessened. Mr. Macloskie presses the core laminæ into cup shape, and assembling them so that their central portions will project into the space beneath the ends of the armature coils at the commutator end of the armature; while at the opposite end of the core a cavity is provided for the reception of the extended journal bearing, permitting also of the free flow of air between the end of the core and the bearing. This invention is applicable also to dynamos and motors wherein a central hub sleeve or spider is employed for supporting the laminæ.

ELECTRIC LOCOMOTIVES.—A couple of patents granted to William Dalton and Francis J. Cole have been assigned to the American Locomotive Company, of New York, the object of these inventions being to provide means whereby electric locomotives can take curves of short radius without an independent guiding truck or liability to derailment; referring particularly to locomotives of the type in which a motor is supported at one end upon the driving axle to which its power is transmitted through gearing, and is supported at the other end upon the frame of the locomotive. The broad idea is presented in the first claim of one of the patents which runs as follows: "In an electric locomotive, the combination of two main supporting frame sections, driving axles journaled in bearings in said sections, two electric motors, each supported on one of said sections and adapted to rotate one or more of the driving axles thereof, a vertical coupling pin by which said sections are connected with the capability of relative horizontal movement, and a cab-supporting frame secured rigidly to one of said sections and supported, with the capability of relative horizontal movement, upon the other section." By means of this coupling pin the useful effect of a special radial truck is obtained, while avoiding the use of radius bars.

LIGHTNING ARRESTER.—Mr. Henry E. Raymond, of Schenectady, N. Y., has secured and assigned to the General Electric Company a patent on lightning arresters. It is an application of what he claims to be his discovery of the fact that the tendency of a lightning charge to jump an air-gap is increased by an increase in the extent of the surfaces of the electrode dischargers, which are exposed to each other. These increased surfaces also serve to convey away quickly from the dischargers and the air-gaps the heat generated by the lightning. Mr. Raymond embodies this invention in the standard form of arrester with a non-inductive resistance in series with the air-gap to prevent the line current from continuing the arc formed by the lightning discharge. His drawings show the metallic dischargers of cylindrical form mounted in connection with conducting strips and non-inductive resistances placed in series with the line and supported in the usual clips or brackets. A lightning discharge flowing along the strips will have four contemporaneous paths between the dischargers, the peculiar arrangement of which provides also a very large effective area of spark-gap; while it is believed that a capacity or resonant effect is created which serves to assist the discharge. All the dischargers are rotatable about their axes, and of course the number need not be limited to four.

LETTERS TO THE EDITORS.

Testing Alternators Under Full Load Conditions.

To the Editors of Electrical World and Engineer:

SIRS:—Permit me to comment in a few words on the paper of Mr. W. L. Waters, which you were so kind as to send me. Mr. Waters says: "In ELECTRICAL WORLD AND ENGINEER issue for October 31, Mr. B. A. Behrend describes a modification of the Mordey method of testing large alternators on full load. While advocating the method of connecting the field coils in two groups so that the e.m.f. induced by one group opposes that due to the other, Mr. Behrend does not bring forward any experimental evidence to show that the results as regards heating, efficiency and regulation have any claim to accuracy." Mr. Waters informs me that he wrote these lines before he saw the second installment of my paper in your issue of November 14, in which I gave tests which corroborated the accuracy of the improved method which I described in regard to the heating and the regulation of alternators. I have repeated these tests on a number of machines, and I have found them very accurate. I wish to call attention to the curves in the issue of November 14, which seem to me to give very good results. In these tests it was not necessary to bolt down the machine carefully, as there was no jar nor vibration.

In regard to the method recommended by Mr. Waters and also in the editorial of October 31, I should like to remark that if a heat run of a polyphase alternator is made by putting direct current

through the armature with the fields in opposition, the magnetic field set up by this direct current in the stationary armature is itself stationary, and, therefore, the revolving field cuts through it at a speed which corresponds to the full frequency. If the revolving field is supplied with damping circuits, or if the field coils rest against collars made of metal, the eddy currents in these damping circuits or collars are so large that they not only vitiate the results of the test, but they also lead to a considerable increase in driving power. It seems to me that as long as a simpler and much more logical method can be used, this method of using direct current is far-fetched, inaccurate and inelegant. The tests which Mr. Waters describes were all carried out with the Mordey method, and had he tried the improved method recommended in the article of October 31, he would have found satisfactory agreement between this method and the usual way of making the regulation test on a low power factor.

SOUTH NORWOOD, OHIO. B. A. BEHREND.

Metric System and Foreign Trade,

To the Editors of Electrical World and Engineer:

SIRS:—On page 398 of your issue of September 5 you make the following statement: "Setting aside the matter of the intrinsic merit of the metric and English systems, the fact remains that the latter is a handicap to our foreign trade, and to study and research in the engineering and scientific literature of the continent." By this I surmise that you take your stand upon the so-called "foreign trade argument" as the rock of salvation for the metric system, and I, therefore, take the liberty of saying a few words on this subject, particularly in view of some new and very interesting, and to you, I am sure, quite acceptable evidence which has just come to light. I refer to a document just published by the French Society of Civil Engineers, consisting of replies to a certain series of questions, which was submitted by the American Chamber of Commerce in Paris. The replies to these questions were undertaken by a commission composed of seven prominent members of the society, all, of course, thoroughgoing metricists. There are thirty of these questions, but I will quote here only those which concern immediately the argument in question, and the answers given.

"*Question* 18.—Has the use of the *bushel* in the United States ever had any influence on the total importations of cereals into France, and why?

"*Question* 19.—In like manner, has the use of the *gallon* in the United States been the cause of any diminution in the importation into France of petroleum, oils, wine, alcohol and other liquors, and why?

"*Question* 20.—Similarly, has the use of the *pound* in the United States had any influence on the quantity of cotton, copper, coal, etc., imported into France?

"*Replies* 18, 19 *and* 20.—It is difficult to reply to these three questions. All the products measured by means of the bushel, gallon and pound are the object of important transactions which always arrive in complete cargoes. The calculations for the conversion of these units into metric units are not then everyday calculations, and are effected but once for considerable quantities. This question of unity of measure is, therefore, certainly less important in these particular cases. The conditions of price and quality outweigh all others.

"*Question* 21.—The machine tools, locomotives, typewriters, bicycles, etc., manufactured in the United States, are constructed with the aid of English measures. It is fair to say, in so far as concerns most particularly machine tools, that certain members, such as leading screws and verniers, are constructed according to the metric system when the machines are destined for France. Has the fact that all these machines are, aside from this detail, constructed with English measures ever influenced their importation into France, or compromised in any manner whatever their efficiency and their output in French factories?

"*Question* 22.—Supposing for the moment that American machine tools were completely drawn up under the metric system, would there result any increase in the number imported into France? Would France have used more machines than she has used during the last five years on this supposition, or supposing that the general adoption of the metric system by the United States was an actuality?

"*Replies* 21 *and* 22.—So far as concerns small machine tools, apparatus, such as bicycles, typewriters, etc., which are sold by the piece, the question of the unity of measure is of small importance; however, so far as concerns typewriters, American constructors have been obliged to combine the keys of the apparatus in such manner as to satisfy the necessities of the French language. . . .

"*Question* 23.—Is it not reasonable to admit that the choice of machine tools is dictated only by the practical considerations of output, efficiency, price, time of delivery, etc., and independent of the system of weights and measures utilized in their construction?

"*Reply* 23.—Although the choice of machines is dictated by practical considerations of output, efficiency, etc., and the United States appear to combine advantageous conditions, we have just stated that countries employing the metric system seem to apply by preference to countries whose system of measures is in harmony with theirs, etc., etc.

"*Question* 24.—Can it be admitted, on the other hand, that the United States would import from France a greater quantity of silks, feathers, leather, machines, musical instruments, optical instruments, instruments of precision, wines, automobiles, etc., if France used the English system of weights and measures? Is it not logical to recognize that the importance of products imported from France into the United States is entirely independent of the system of measures employed in the two countries, and depends exclusively on quality, output, adaptability, price and time of delivery of these products and conforms to the general law of supply and demand?

"*Reply* 24.—The system of measures employed, whatever it may be, is evidently without effect on the products to which these measures have no application, such as silk, flowers, feathers, confectionery, etc.

"Whatever may be the system employed, France cannot pretend to export to the United States anything but products whose conditions appear favorable to the latter country. France will be subject to the effects of the law of supply and demand; the effects of this law are largely influenced and often obscured on the American market by the action of prohibitive tariffs, etc., etc.

"*Question* 25.—From this point of view, can it be affirmed that the importance of the commerce between France and the United States would have some chance to grow under the hypothesis that the United States adopted the metric system, or France the English system of weights and measures? If the reply is affirmative, under what conditions would this increase be produced, and why?

"*Reply* 25.—The replies to questions 18, 19, 20, 21, 22 and 23 reply to this question."

Here you have a simple and direct interrogatory put from the American side, and containing all the points which are of interest to American manufacturers, so far as concerns foreign trade; and there you have the answers of this eminent body of French engineers in cold type. What more can be said on the subject? It is plain from these answers that in not one case, which is of the slightest importance to United States manufacturers, would the adoption of the metric system have any appreciable effect whatever as regards France, and the same can be said of any other country. The fact, then, which remains is not, as you say, the "foreign trade argument," but that this so-called argument is a product of the imagination of the people engaged in promoting the metric system. It seems a pity to use this venerable spook, which has done business for half a century, so harshly, but is it not about time to lay it in its grave?

If the prometric people wish to convince American manufacturers that they need the metric system in their business, they will have to begin with some other stock in trade than the "foreign trade argument." I cannot help making the following further reflection, as it seems so extremely pertinent to the occasion, and calls itself so prominently into view: America produces more steel, more copper, more cotton, more machine tools and more agricultural machines than all the rest of the world put together; and more coal, iron, textiles, cereals and many other classes of commodities than any other country. The value of her manufactures is triple that of all Europe put together, and the clearing house exchanges at New York are double those of London.

Mr. S. S. Dale, editor of the *Textile World Record*, writes me: "The manufactured silk products of the United States is larger than that of any other country. The American textile industry, particularly the cotton branch, is growing by leaps and bounds, while the industry in other countries is stationary, or increasing very slowly. The English system of weights and measures is the standard for numbering cotton yarn throughout the whole world, except France, and the French use a system that is not metric." Will some one

on the other side please explain how such things can coexist, for on the metric theory it is an impossibility?

Under these circumstances is it not somewhat ludicrous, to say the least, to talk about running after a country of diminishing population and increasing debt, like France, to get a theoretical advantage for which nobody who is responsible for these great sources of wealth has any use? Why should the mountain go to Mohammed? In this calculation we have left out Great Britain altogether, and the comparison would hold true even were Great Britain a metric country; but the talk about the possibility of Great Britain "adopting" the metric system there, governmentally or popularly, is pure out-and-out rubbish. Even were the government to adopt it, the people never could be got to do so, and even were the people to adopt it, the government certainly would not do so until fifty years afterward. This matter has been so clearly shown from the discussion in England relative to decimal currency, a brief history of which I have given in my paper on the metric system (*Trans.* A. S. M. E., December, 1896), that nobody who is capable of comprehending the meaning of history can have any doubts on the subject.

MILWAUKEE, WIS. GEORGE W. COLLES.

DIGEST OF CURRENT ELECTRICAL LITERATURE.

DYNAMOS, MOTORS AND TRANSFORMERS.

Direct-Current Dynamo Design.—POOLE.—A paper discussing a method of predetermining direct-curent dynamo or motor characteristics with regard to sparkless operation, and also a system of designing applicable to a complete line of mechines of a given type or class. The author advocates the application of the ratio between the e.m.f. induced in a coil and the reactance e.m.f. of the coil during commutation as the criterion of sparklessness, and describes his method of arriving at these two values. The reactance e.m.f. is deduced according to the method of Hobart and Parshall; the e.m.f. induced in the coil by the field flux during commutation is approximated on the basis of the average flux density over the pole face, with a correction for the effect of the cross ampere-turns on the armature. The method applied to the designing of a full line of machines consists broadly in expressing as many variable factors as possible in terms of the armature diameter; the magnetic density at the pole face is made proportional to the $\frac{1}{6}$ power of the armature diameter, the speed to the $\frac{2}{3}$ power, the air-gap length to the $\frac{5}{6}$ power, and so on. This method works out to the simple formula, $Kw = 0.022\ D^{1.5}\ LpP$, D being the armature diameter, Lp the axial dimension of the pole face and P the number of poles. The paper contains too many formulæ and tables to admit of abstracting them. —*Jour. Frank. Inst.*, November.

Weight and Cost of Electric Machines.—BRESLAUER.—In a review of progress in electrical engineering, the author shows that the weight and price of electrical machines have been reduced now to nearly one-half what they were seven years ago. Fig. 1 gives the results for

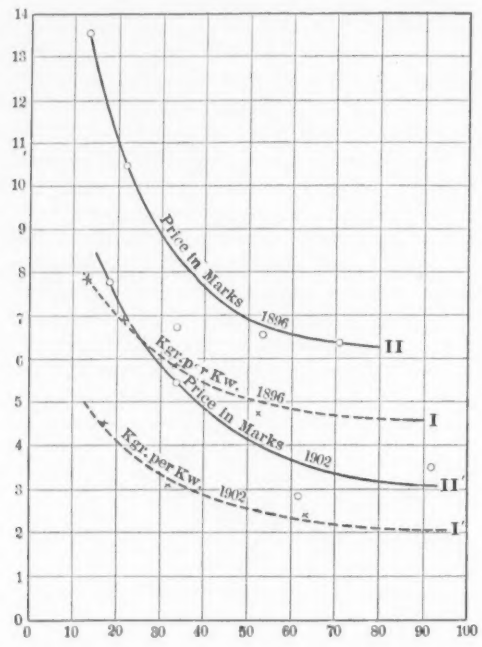


FIG. 1.—WEIGHT AND COST OF ELECTRIC MACHINES.

machines built by a German manufacturing company. The curves I and I' give the kilograms per kilowatt in 1896 and 1902, respectively, each scale division of the ordinates representing 10 kg. The curves II and II' give the price in marks per kilowatt, each scale division of the ordinates representing here 10 marks (or $2.50). All figures have been reduced to a uniform speed of 1,000 r.p.m. It will be seen that with modern machines the same power is obtained with only one-half weight compared with 1896. It will also be seen that the price has been reduced very considerably in the same time. This change is due to refinement of design and not to any radical changes. Radical changes have, however, been introduced recently, especially by Behn-Eschenburg, Fischer-Hinnen and Deri, who remove armature reaction and field distortion in direct-current machines by means of compensation windings. The importance of this invention is said to be evident in its application to the Ilgner system of operating hauling machines. It is believed that this machine will find much application to mining.—*Zeit. f. Elek.* (Vienna), October 25.

Output Coefficient.—BURLEIGH.—A communication with reference to the recent articles of Hobart and Esson. He does not think either of the methods advocated by these authors to be on a fair comparative basis, i. e., the output of a machine does not vary directly proportional to the peripheral surface of the armature; neither does it vary as $D^2 \times L \times C \times r.p.m.$ The correctness of this criticism is proven by the necessity of changing the value of the coefficient, C, for every different size of dynamo, although it may be a line of machines designed on the same basis. The writer suggests the following method of obtaining a coefficient, the value of which can be easily determined and which forms a simple and reliable means of comparing dynamos by their specific output coefficients. The output coefficient is defined by the equation, $C = D\ L/\sqrt{W}$, in which C is the output coefficient, D the diameter of the armature in inches, L the length of the armature in inches over laminations, and W the watts generated per revolution. If the number of revolutions per minute is R, we get the output in watts equal to $(D\ L/C)^2\ R$.—Lond. *Elec.*, November 6.

Heyland Motor and Generator.—BRESLAUER.—In a review of recent inventions in electrical engineering the author discusses the prospects of the Heyland commutator type of alternating-current induction motors and generators. While tests of machines built according to this principle have proven the correctness of the theory, yet the complications due to the commutator may be expected to prevent the universal application of the compensated motor instead of the small ordinary induction motor. On the other hand, the Heyland principle seems to promise great practical advantages in its application to generators, since it removes all difficulties in operating alternators in parallel. This should be of great importance in view of the increasing use of gas engines. Still more surprising appears the latest invention of Heyland by which the compensation principle is applied to the normal synchronous machine. The firm of Kolben & Co. have already built such machines and have obtained favorable results so that they have now undertaken the manufacture of a larger number of such machines up to 1,500 kw.—*Zeit. f. Elek.* (Vienna), October 25.

Formulas for the Comparison of Dynamo-Electric Machines.—PICOU.—An article in which the author, after some general remarks on the value of formulas for the "output coefficient," etc., discusses at some length the special formula, which he attributes to Kapp, and which states that the power is equal to the output coefficient multiplied by the square of the armature diameter by the armature length and by the angular speed. He shows how this formula may be de-

rived theoretically and gives two formulas for the output coefficient as function of other details of the design, one of the formulas relating to smooth, the other to toothed armatures.—*L'Ind. Elec.*, October 25.

REFERENCE.

Formulas for Designing Electric Machines.—SENGEL.—An article in which the author refers to recent publications of Arnold, Rothert and Dick and gives a series of formulas which he has derived from the dimensions of existing machines. From the formulas of the other authors mentioned his formulas differ, especially because he takes into account the number of poles, and uses as the basis for designing a dynamo the useful number of lines of force which pass per pole into the armature. He deals with direct-current generators, alternating-current generators, transformers and induction motors.—*Elek. Zeit.*, October 29.

LIGHTS AND LIGHTING.

Alternating-Current Searchlights.—In the use of alternating current for operating electric searchlights, the arrangement of the two carbons perpendicularly above each other or side by side in a horizontal direction, has the disadvantage that the arc light, which is generated, is utilized to a comparatively small degree, only one-third

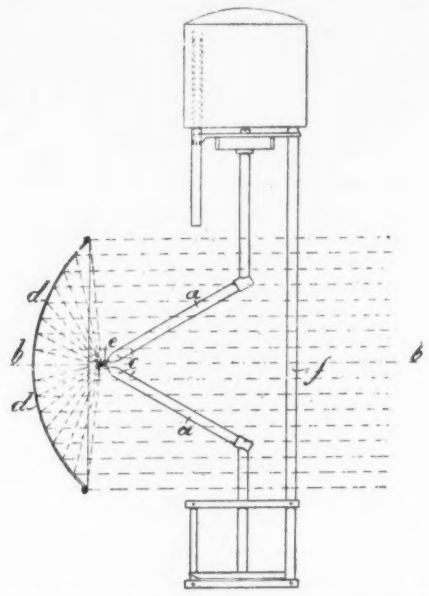


FIG. 2.—ALTERNATING-CURRENT SEARCHLIGHTS.

of the light rays falling upon the reflector. To counteract this disadvantage, two different arrangements have been devised by Weinert and Engelsmann. Weinert's device is shown in Fig. 2, and it is stated that the light effect produced is higher by 60 or 70 per cent. than with perpendicular or with horizontal carbons. The device of

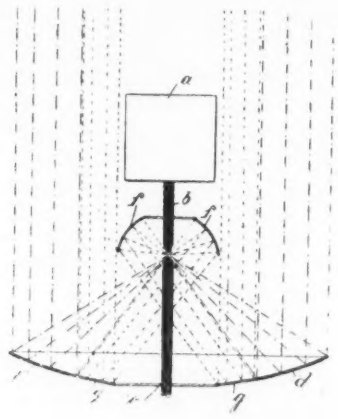


FIG. 3.—ALTERNATING-CURRENT SEARCHLIGHTS.

Engelsmann, who uses two reflectors, is shown in Fig. 3. Both figures are self-explanatory.—*Zeit. f. Beleucht.*, October 30.

Arc Lamps.—BRESLAUER.—In a review of recent inventions in electrical engineering the author discusses the success of several firms supplying arc lamps of smaller candle-power than usual, for instance, lamps of 2.5 amp. and 120 candles. It is thought that such lamps might successfully compete with incandescent gas light in public buildings, restaurants, etc. An Italian engineer, Rignon, is said to have devised arc lamps for 1 amp. with 1 mm. carbon. The German patents of this invention have been bought by the Allg. El. Ges., of Berlin.—*Zeit. f. Elek.* (Vienna), October 25.

REFERENCE.

Thorium Filament.—For incandescent lamp filaments, thorium is very suitable on account of its high melting point and its high electric resistivity, but the manufacture of thorium filaments is extremely difficult, and such filaments are mechanically weak. The Siemens & Halske Company, of Berlin, therefore, use a filament of a mixture of thorium with some thorium carbide.—*Zeit. f. Beleucht.*, October 30.

POWER.

Refuse Destructors.—A report by the surveyor and the electrical engineer of Hammersmith on the advisability of installing refuse destructors. They arrive at the following conclusions: First, that in the case under consideration barging away is more economical at the present time; second, that the refuse has not sufficient calorific value to justify the combination of a dust destructor with the electricity works; third, that there is every probability that the cost of cremation of refuse will greatly decrease, whereas the cost of barging is more likely to increase. A time will come when the destructor will be necessary, and it would be good policy to obtain the necessary ground at once. Figures are given of the annual returns of six London municipal electric lighting stations, three of these having the assistance of destructors, and three being operated with coal only. The capital expenditure per kilowatt is $400 for non-destructor stations, and $590 for destructor stations. "The working costs of non-destructor stations is 0.4 per cent. per unit higher than the destructor stations, which, upon 5,774,644 units (their total output), represents $24,475. The extra cost of the capital involved to effect that saving is, at 5 per cent., apparently $36,975, showing a net loss of $12,500 per year as the cost of combining dust destructors and electric lighting stations." It is editorially remarked that the extra cost of the capital due to the installation of destructors thus considerably overbalances the saving in fuel costs; but this does not take into account the inconvenience of the electric lighting undertaking due to irregularities of steam pressure and supply, to say nothing of the intolerable smell and dust. If combined destructor and electricity works are really as successful as their advocates claim them to be, the various supply companies would be only too anxious to adopt them. The local authorities could then get rid of their refuse at very little expense, while the supply companies would destroy it free of charge in return for steam generated. But supply companies are generally concerned with money-making and are not yet convinced that such combined stations have a tendency in this direction.—Lond. *Elec.*, October 30.

Fly-Wheels.—STROHM.—An illustrated article on fly-wheels and fly-wheel accidents. If the steam boiler be conceded the unenviable position of first in the line of destroyers, fly-wheels should rank very close to it. He deduces the formula for the energy stored in a rotating fly-wheel, and considers the tensions and stresses set up in it. The primary cause of fly-wheel destruction is excessively high rotative speeds, and this may be brought about through a multiplicity of causes. The bursting speed of a solid rim-cast wheel is about 425 ft. per second; but it is customary to make this not more than 100 ft. per second. At this speed the tension per square inch of rim section is 1,000 pounds, which gives a factor of safety of 18, which is quite large. But it is not possible to construct all fly-wheels of the one-piece type for many reasons. Hence, it is generally found that fly-wheels from 10 to 15 ft. in diameter are cast in halves, and bolted together strongly at the hub and at the rim. The joint thus formed, however, constitutes a weak point in the construction. The author considers the various ways of holding fly-wheels of large diameter together.—*Am. Elec.*, November.

TRACTION.

Polyphase Traction.—BRESLAUER.—In a review of recent inventions in electrical engineering the author discusses the recent experiments of Lamme and Finzi. He thinks that, however successful both may be, they have not solved the problem to feed the motor with high-tension current directly from the trolley wire. This would

be desirable in order to overcome the necessity of carrying the heavy transformers on the cars. A voltage of 10,000 on the trolley wire would be desirable for long-distance lines. He thinks that the solution of this problem is approached on the suburban line between Berlin and Spindlersfeld, where a single-phase motor is used, which is said to have the well-known properties of the series motor, a voltage of any amount being supplied only to the stator. That road is operated at 6,000 volts. No exact information is yet available concerning the methods by which this result has been obtained, except that Winter and Eichberg have here applied the same principle which they applied before in their three-phase motor, transformed variable voltage being supplied to the collector of the rotor. By selecting a low voltage at the collector and by special windings, the danger of sparking has been overcome. The author remarks that any repulsion motor gives the possibility of working directly with high voltage in the stator. The superiority of the Winter-Eichberg motor seems to be a higher power factor, as it is claimed that a power factor equal to unity may be obtained.—*Zeit. f. Elek.* (Vienna), October 25.

Electric Traction in Canals.—PETIT.—A long article illustrated by diagrams on the question whether for electric traction of canal boats it is preferable to have the electric locomotive run on the ordinary towpath or on rails along the canal. A full account is given of experiments made by Gérard on the canal from Charleroi to Brussels, according to a report made by him to the Duesseldorf International Congress of Navigation. The decision reached for this canal is that the use of rails would save $520 per km. per year under the supposition that the maintenance of the towpath in a condition required for electric traction would be $380 against $64 for the maintenance of a road with rails capable of carrying the mechanical apparatus of a weight of 4,000 to 6,000 pounds. The problem investigated by Gérard is essentially a mechanical one and refers to the traction effort required for hauling barges. The experiments were made by bringing the boats to a certain speed, then allowing them to drift along and measuring the decrease of the speed and therefrom the retardation. The results were plotted in forms of curves. One of the interesting results obtained is that there are to be distinguished three regions of speed; in the special case under consideration the first is from zero speed to 1.5 km. per hour, the second from 1.5 to 3, the third from 3 to 4 (4 km. per hour being the maximum speed allowed on canals in Belgium). In the lowest class of speed the traction effort is nearly constant. Above a speed of 1.5 km. per hour the traction effort varies rapidly with the speed; it is 147 kg. for a speed of 4.2 km. and 21 kg. for a speed of 1.5 km. In the lowest region of speed (up to 1.5 km.) the level of the water remains uniform and the boat is not raised. For a speed between 1.5 and 3 km. a stream of water is produced between the walls of the canal and the barge in a didection opposite to the movement of the barge. For a speed between 3 and 4 km. the level of the water is raised before the boat and, in general, the level of the water shows distinct deformation at both sides and at the end of the boat. From the experiments it was deduced that it is theoretically possible to start without slipping on rails, even on wet rails. While the first cost of installing a roadway with rails will be higher than without rails, the cost of maintenance will be considerably lower for the former system and this is, therefore, preferred. The polyphase induction motor is believed to be thoroughly suitable for this kind of work.—*La Revue Tech.*, September 25.

San Francisco.—An article on the San Mateo extension of the United Railroads of San Francisco. This railway was built for interurban service, but a considerable portion of the line extends through city streets and suburban districts where the speed is restricted, while in the open country between towns the company has secured a private right of way and operates its cars at a very high schedule. The construction work of the line is all of very high standard, both overhead and in the permanent way. Power is furnished from the Bryant Street power house, the San Mateo line being divided into three sections. Direct current at 550 volts is supplied to the first section directly from the power house, while the other two sections get current from two sub-stations.—*St. R'y Jour.*, October 31.

REFERENCE.

Brussels Tramway System.—REYVAL.—A profusely-illustrated description of the power plant and sub-stations of the Brussels tramway system. The total network comprises about 50 miles double track, with 109 trains of 15 tons in ordinary service and 295 trains of the same weight during rush hours. The power plant contains four three-phase alternators, each giving 1,500 kilovolt-amp. at 6,600 volts. The frequency is 25. There are three sub-stations with transformers and synchronous converters.—*L'Eclairage Elec.*, November 7.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Motor-Generators Versus Rotary Converters.—HOBART.—The conclusion of a very long article, illustrated by diagrams, which has been published in form of a serial in this journal for some time. The final results of a series of diagrams show that only in cases where the distance of transmission is so short the voltage so high, or the outlay for cables so great that a very low resistance per phase is obtained, can rotary converters be satisfactorily operated for automatic control of the commutator voltage for practically constant voltage at all loads, much less then for 5 per cent. or 10 per cent. higher commutator voltage at full load than at no load. Even with a low resistance per phase, it is necessary to provide large, expensive and wasteful auxiliary reactance coils in order to obtain satisfactory voltage control by automatic phase adjustment, and for anything more than a very low resistance per phase there is soon reached a value of the reactance beyond which it is ineffective in improving the conditions in this respect. In fact, with shunt-excited rotary converters, and even with a small percentage of series winding, reactance makes the regulation still worse. A large percentage of series winding is very important from the standpoint of regulation of the commutator voltage by phase control. The principles developed by the author are finally applied to a typical case, and for this purpose the Central London Railway is chosen. Owing to the short distance of 6¼ miles from the power house to the most remote sub-station, the conditions are especially favorable to a fair showing for rotary converters. The original sub-station installation consisted mainly of six 900-kw synchronous converters, 21 air-blast transformers, each of 300 kw, with blower sets for circulating the air through them and all necessary switch gear and auxiliary apparatus. These were located in three sub-stations, distant respectively 1.6, 3.5 and 6.2 miles from the generating station. The average distance is, therefore, about 3.8 miles. The cost of the high-tension cable equipment is estimated at $90,000; that of the six converters at $67,500; that of the transformers and ventilating motors at $31,500, and that of the switchboards and gear at $27,000. If one were to lay out a plant of similar capacity with motor-generators, ⅔ as great total copper cross-section in the cables would be ample, less subdivision of the cables would be necessary, and three independent cables from the power house would give fully as great security as the four cables employed in the rotary converter installation. Hence, the individual cables would have but slightly less cross-sections of copper per core, and the specific cost would be but slightly increased. The cost of the cables is estimated at $62,000. The cost of motor-generator is taken 75 per cent. higher than that of the rotary converters; that is, $118,000. The transformer item falls out. The outlay for switchboards and gear may be taken ⅔ as great kilowatt since the number of panels, switches, bus-bars, etc., may be greatly reduced and simplified. The cost of switchboards and gear is taken as $18,000. He, therefore, arrives at a cost of $216,000 for rotary converters against $198,000 for motor generators. Whether the interest on this 9 per cent. less outlay for the motor-generator scheme would affect the 3 per cent. to 6 per cent. lower efficiency of operation, would require a careful analysis of the operating costs. The author does not intend to assert that in the Central London plant the use of motor-generators would have led to ultimate higher earning capacity, but this example serves to illustrate the basis on which a comparison should be made, and shows that with longer systems requiring a greater proportional outlay for high-tension cables, the balance tends towards showing an economic advantage to be gained by the use of motor generators. —Lond. *Elec. Rev.*, October 23.

Copenhagen Central Station.—HENTZEN.—A long and profusely-illustrated description of the new Oestre electric plant, which is the third municipal station of Copenhagen. There are now three municipal stations in Copenhagen, each one being situated about the center of gravity of the lighting system which it supplies with current. The new station contains three steam-driven, direct-current dynamos of a normal capacity of 500 kw and a maximum capacity of 600 kw, running at a speed of 100 r.p.m. The current is used both for traction and for lighting and power. It is distributed by the third-wire system with 220 volts between each outer and the neutral. Storage batteries are connected in parallel with the dynamos. The battery

for lighting contains 272 cells of about 2,750 amp.-hours' capacity. The battery for traction contains 270 cells, of about 900 amp.-hours' capacity. For charging the latter battery, which requires a voltage of 700 volts, a booster is provided which is connected in series with the main dynamos. It is driven by a motor and gives an additional voltage up to 180 volts, with 500 amp., which is the normal current required for charging. There is also installed a balancer which, either in conjunction with the lighting battery or alone, serves to balance the voltages in the lighting network. It consists of two dynamos mounted on the same shaft, of 220 to 250 volts and 132 amp. The mechanical equipment, especially of the boiler and engine room, is described in detail.—*Elek. Zeit.*, October 29.

Engine and Dynamo Breakdowns.—An illustrated abstract of Longridge's annual report on breakdowns of engines and dynamos insured by the Engine, Boiler & Employers' Liability Insurance Company. Of dynamo breakdowns, 17 per cent. were due to accident, 25 to dirt or neglect, 15 to deterioration, 15 to bad workmanship or design, 5 to overload, and the causes of 23 per cent. were unascertained. Of the motor breakdowns 13 per cent. were due to accident, 18 to dirt or neglect, 26 to deterioration, 15 to bad workmanship or design, 13 to overloading, while the causes of 15 per cent. were unascertained. The parts which failed first in the dynamos were armatures and rotors, 68 per cent.; magnet coils and stators, 9 per cent.; commutators and brush gear, 12 per cent.; miscellaneous, 11 per cent. The parts which failed first in motors were armatures and rotors, 54 per cent.; magnet coils and stators, 16 per cent.; commutators and brush gears, 21 per cent.; miscellaneous, 9 per cent. Some curious accidents are recorded.—Lond. *Elec. Rev.*, October 30.

WIRES, WIRING AND CONDUITS.

Insulating Paper.—BEAVER.—A communication stating that most of the commercial "Manila paper" has no appreciable proportion of Manila fibre in it, but is full of wood and straw. Such paper is utterly unsuitable for cable or other insulating work. Engineers should insist on having their Manila papers free from wood pulp of any kind or from fibres of the straw and esparto class.—Lond. *Elec.*, October 30.

NEIGHBOUR.—Another communication on the same subject. He agrees that it is very difficult to obtain pure Manila paper. This is due to two causes: first, the difficulty of obtaining sufficiency of the fibre, and second, the great stringency of the specifications provided by electrical engineers. For instance, it is sometimes specified that the paper is to be absolutely free from knots, pinholes, etc. This is a requirement which cannot be fulfilled with pure Manila paper, since Manila, unlike most other fibres used in paper making, must not be beaten too fine if the strength of the web is to be maintained; so that a few pinholes and a considerable number of knots and unbeaten fibres in "pure" Manila paper are inevitable. On the basis of some years of experience the writer claims that a wood paper made from a good, clean sulphite pulp and carefully cleared from acid—considering its strength and uniformity of texture, its price and also its freedom from grits, metallic particles and pinholes—has a more than even chance in disputing the field with its more expensive rival. —Lond. *Elec.*, November 6.

Underground Concrete Conduit.—A note on a recent trial at the Metropolitan Railway power station of a new system of underground concrete construction. Iron pipes, about 4 ft. in length, were coated with a 1 to 4 mixture of paraffin wax and graphite to a thickness of about ¼ in. These were then screwed together to form one piece of any desired length, and after being placed into position they were firmly embedded in concrete. After some days the concrete has dried and becomes firmly set. If steam is then passed through the pipes, on account of the low melting point of the paraffin wax mixture it is possible to withdraw the pipes, leaving a layer of mixture on the inside of the concrete conduit. This layer, it is claimed, acts as an excellent lubricant and enables cables to be drawn in with great ease and minimum abrasion. The cost is from 25 cents to 31 cents per year-run of conduit. The opinion is expressed that for long lines of cable the application of the system will be attended with difficulties on account of the fact that the steam passing over greater lengths cools down. The principal advantage is said to be due to the fact that the conduit when completed is absolutely seamless, manholes being placed at intervals of about 150 yards.—Lond. *Elec.*, October 30.

ELECTRO-PHYSICS AND MAGNETISM.

Combined Coherer.—TURPAIN.—An account of experiments in which a number of coherers were connected in parallel attached to the same antenna. They preserved their relative sensibilities whether in open or closed circuit, but the sensibility of each was much less in an open than a closed circuit. The order of sensibility may be rapidly determined by producing waves which just make the most sensitive coherer respond, and then cutting out that coherer while increasing the strength of the waves until the last coherer is cut out in the same manner. The author also connected several coherers in series, and again determined their relative sensibility by exposing them to the same wave-train, and then measuring for each coherer separately the amount of cohesion as indicated by its conductivity. In this case the order of sensitiveness of the various coherers changes with the connection, since the coherer which is directly attached to the antenna has a greatly-increased sensibility. The author has adapted these results to the measurement and automatic registration of thunder storms, and also to the construction of very sensitive detectors both for wireless telegraphy and for Hertzian wire-wave telegraphy, but he gives no details of these applications.—From *Comptes Rendus*, October 12; Lond. *Elec.*, October 30.

Coherer.—ROBINSON.—A continuation of his researches with a single-contact coherer, consisting of two straight pieces of copper wire, which carried at one end steel caps. These rods were suspended by silk threads, and the steel caps, the ends of which were spherical, pressed slightly against each other and formed the single-contact coherer. In using the coherer with direct current, it was noticed that on applying to the coherer ends a potential difference greater than the critical potential difference, the resistance of the coherer fell almost instantaneously to a certain value, which he calls "impulse value." It then dropped slowly further until the relation of the resistance of the coherer to the resistance of the circuit was such that the resulting potential difference at the coherer ends took on a definite value which was called the "equilibrium potential difference." In the course of experiments it was noticed that the regularity of the results increased markedly as the applied potential difference became greater. The greater the applied voltage, the smaller is the impulse value of the coherer resistance, the relation between the two being evidently not a linear one. The greater the sensitiveness of the coherer, the smaller is the impulse value of the coherer resistance for the same applied voltage.—*Phys. Rev.*, October.

REFERENCE.

Radioactivity.—PARTRIDGE AND BRADBURY.—A Franklin Institute paper which gives a good summary of the subject. They discuss its history, describe the preparation and properties of polonium and radium and the chemical and physiological effects of Becquerel rays, refer briefly to various hypotheses on the sources of energy emitted by radioactive substances and notice the phenomenon of induced radioactivity.—*Jour. Franklin Inst.*, November.

ELECTRO-CHEMISTRY AND BATTERIES.

Alkaline Accumulators.—SCHMIDT.—A general discussion of the advantages of alkaline accumulators. Their chief merit lies in the fact that, apart from water, no constituent of the electrolyte enters into the reaction, so that a relatively small amount of electrolyte is required and the weight is reduced. The final result of the discharge may be described as a transference of oxygen from one electrode to the other electrode through the medium of water. The author points out that any metals whose oxides are insoluble in alkalines are suitable for electrodes in alkaline accumulators. Such are the ordinary metals, cadmium, iron, nickel, copper, mercury and silver. Zinc oxides are soluble in alkalines, but not in alkaline silicates, aluminates or carbonates. Accumulators consisting of two electrodes of the same metal are most disadvantageous, since self-discharge by the accidental deposition of one metal upon the other is avoided. The difficulties encountered are mainly mechanical, and concern the mounting of the oxide in the shape of cohesive and yet porous masses. The oxide has to be prepared beforehand as is done by Edison in his nickel-iron accumulator, and is contained in small metallic boxes closely packed. The oxide is utilized to a greater extent the nobler the metal. In silver the utilization reaches 100 per cent. The yield of Edison's accumulator is now given as 25 watt-hours per kg, but the efficiency is stated to be less than that of lead accumulators and the price is higher.—From *Mit. Phys. Ges. Zürich*, No. 5, in Lond. *Elec.*, October 30.

REFERENCES.

Production of Copper, Nickel and Zinc from Chloride Solutions.—KOEHLER.—The first part of an illustrated historical and critical sketch of the development of the production of copper, nickel and zinc from chloride solutions. In the present compartment the work of Body and the early experiments of Hoepfner are mainly dealt with.—*Electrochem. Ind.*, November.

Primary Batteries.—HILDEBRANDT.—The first part of an article on "constant cells," in which the author gives a brief historical sketch of the development of practical primary batteries. In this instalment he deals especially with the Daniell, Grove and Bunsen cells.—*Centralbl. f. Accum.*, November 1.

Classification of Electrochemistry.—TOWNSEND.—The conclusion of his article on systematic classification of the various subjects of electrochemistry. His scheme of classification has recently been adopted unofficially by the patent office and is now the working system by which the United States and foreign patents are classified in the examining division. He gives brief notes of comment upon the scope of the subdivisions to indicate the character of the material included therein.—*Electrochem. Ind.*, November.

TELEGRAPHY, TELEPHONY AND SIGNALS.

REFERENCES.

Wireless Telegraphy.—PRASCH.—The conclusion of his article illustrated by diagrams on the characteristic distinguishing features of the various systems of wireless telegraphy. A summary is given in form of a table.—*Zeit. f. Elek.*, October 23.

Wireless Telegraphy.—TURPAIN.—A complete account of the proceedings of the International Conference on Wireless Telegraphy, recently held in Berlin.—*L'Eclairage Elec.*, October 31.

Printing Telegraph.—An illustrated description of Steltje's type printing telegraph.—*Sc. Am.*, November 7.

Telephone Engineering.—DOMMERQUE.—Another article of the serial on telephone engineering, this one dealing specifically with aerial cable lines.—*Am. Elec.*, November.

MISCELLANEOUS.

Aluminothermics.—GOLDSCHMIDT.—An exhaustive and profusely-illustrated description of the various engineering applications of the author's thermit process. The author describes in detail the applications of the process to rail welding (see ELECTRICAL WORLD AND ENGINEER, November 21, page 854), to repairing broken machinery, especially broken stern-posts of steamers, to welding wrought-iron tubes and solid rods, to the repair of castings, and the use of "anti-piping thermit" for improving iron and steel castings and preventing blow holes and piping. The author recently made experiments to find whether silicon could be substituted for aluminum in the thermic reaction. While silicon has a very high oxidation heat, the speed of reaction is slow, and even if only part of the aluminum is replaced by silicon the process is unsuitable for engineering purposes.—*Electrochem. Ind.*, November.

Physiological Effect of Zinc Ions.—LEDUC.—Under this title an account is given of experiments which show the marked effect of an electrodeposition of zinc upon the growth of hair. Two electrodes of 10 sq. cm. surface were applied to the ends of a space 10 cm. by 6 cm. on the shaven skin of a rabbit, contact being made by means of hydrophil cotton impregnated with a 1 per cent. solution of zinc chloride. A current of 10 milliamp. was passed for 40 minutes. At the end of that time nothing was seen at the cathode (where the current leaves the skin), but at the anode (where the current passes from the zinc chloride cotton into the skin), there were a number of small white circles, showing that the zinc had penetrated into the skin. In about eight days these circles peeled off. The zinc having been introduced on July 10, the hair on the place of application of the anode showed a decided growth on the 20th, the hair on that place growing much faster than that on the other shaven surface. On August 3 the hairs were 5 mm. or 6 mm. long and on August 10 they were 10 mm. long, whereas on the other parts of the shaven surface, including that under the cathode, the growth was insensible. The surface where the zinc had been introduced was marked out by a thick fleece of gray hair on a buff background. A similar introduction of chlorine and, in another experiment, of potassium, exerted no action on the growth of hair.—From *Arch. D'Elec. Med.*, October 15; Lond. *Elec.*, October 30.

REFERENCE.

Obituary.—A brief account, with portrait, of the life and work of the late Dr. Richard Fellinger, chief of the Vienna Siemens & Halske Works.—*Zeit. f. Elek.* (Vienna), October 25.

New Books.

ELEMENTARE VORLESUNGEN ÜBER TELEGRAPHIE UND TELEPHONIE. By Dr. Richard Heilbrun. Berlin: Georg Siemens. 63 pages, illustrated.

We have already had occasion to notice the four preceding parts of Dr. Heilbrun's serial upon the telegraph and the telephone. The number before us takes up telegraphic instruments at the point where No. 4 closed, and it is largely taken up in a description of telegraphic receiving instruments, both of the Morse form and the various dial patterns of apparatus more common in Europe than in this country. Next follows a chapter upon the various forms of electrical supplies chiefly for telegraphic service in which batteries and battery installations are treated. Chapter XV is devoted to a discussion of the operation of the Morse telegraph, but stops in the middle, and the reader is left hanging, like Mohammed's coffin, between this number and the next in a state of somewhat aggrieved wonder as to the nature of the remainder of the discussion. In a similar manner do operators sometimes have the circuit snatched away from them.

ENGINEERING PRELIMINARIES FOR AN INTERURBAN ELECTRIC RAILWAY. By Ernest Gonzenbach. New York: McGraw Publishing Company. 71 pages, 5 illustrations. Price, $1.00.

In this volume Mr. Gonzenbach has taken a prominent electric railway in the West and has shown step by step how the design of the line was evolved from the conditions of population, kind of territory traversed and probable business to be expected.

Unlike many engineering works the book is entirely non-technical, being purely descriptive, but with it Mr. Gonzenbach shows himself to be a consummate engineer, for he has given an example of how to produce a property adapted to the requirements of the territory with the least initial investment and operating cost. His descriptions are so terse and clear and so free from technical terms that even the lay reader becomes interested and has finished the volume ere he is hardly aware of it.

With some of Mr. Gonzenbach's conclusions there are engineers who will probably differ, but each point is fortified with so powerful a battery of common sense reasoning as to make the deductions well nigh impregnable. There are few examples of descriptive engineering that are as complete and thoroughly worked out, yet the reader must not forget that it is a description of a particular case and that therefore the deductions can by no means be necessarily applied to all other electric railways.

DIE STRASSENBAHNEN IN DEM VEREINIGTEN STAATEN VON AMERIKA. By Gustav Schimpff. Berlin: Julius Springer. 190 pages, 224 illustrations. Price, 6 marks.

American engineers have been so busy completing electric railways that they have had very little time to write accounts of this art, and what are in existence are publications chiefly to be found in our own files or those of the *Street Railway Journal*. Perhaps, therefore, it is not strange that from Germany comes a most complete description of American electric railways that is so thorough that doubtless many American constructors will wish for a translation.

The first chapter is an account of what we should term "Urban Lines." The cities of New York, Chicago, Detroit, Cleveland, etc., are illustrated with maps presenting the street railway systems and half-tones showing photographic reproductions of the parts of the streets which the road serves.

Terminal loops receive considerable attention. Then comes a chapter upon track, particularly that of the urban variety, with special attention to rail bonding.

The conducting system comes next with illustrations of both overhead lines and conduit systems. Curiously, the third-rail systems are completely ignored.

The subject of cars is treated at length. Many dimensioned drawings and cross sections are shown and the merits and demerits of the various forms of trucks illustrated at length.

We are now brought to about the middle of the volume at which

point the construction of the power station is taken up and very fully illustrated by plans and sectional drawings from the largest of the railway stations in this country. Electric machinery follows as a sub-division of the power station. A chapter upon the handling of cars, followed by a few pages of American street railway statistics, completes the volume. The illustrations are particularly good and well chosen and the letter press leaves little, if anything, to be desired.

THE ENGINEERING AND ELECTRIC TRACTION POCKET BOOK. By Philip Dawson. New York: John Wiley & Sons. 1411 pages. Price, $5.00.

Few electrical engineers need any introduction to Mr. Dawson, for during the past few years he has made the acquaintance of nearly all the American profession, if only through the previous editions of his pocket book. The one now before us is arranged upon the same general plan as the former editions; but it has grown considerably and now numbers some 1,400 odd pages. In fact, it can hardly be termed a pocket book, for there are few of even the most capacious of pockets into which this volume could be placed without serious inconvenience to the owner; but as a desk companion the new edition will prove even more welcome than the former ones.

There is little to note so far as the general arrangement of the work is concerned, for it is divided into the same sections of track, overhead line and feeders, power stations, storage batteries, conduit systems, general data, testing and maintenance that existed in the earlier editions. But each one of these shows conspicuously the effect of the revision, both in being thoroughly brought down to date in containing much new and useful matter, and in the elimination of errors that formerly existed.

More than ever the work is a data book, explanatory matter having been condensed to a minimum amount, while tabular matter has been expanded. There are few engineering data books that are as cosmopolitan, for the author has very skillfully combined English and American data in such a manner as to make the book valuable to electric railway engineers in both countries. Often an English book is of but little value in this country and conversely, but Mr. Dawson has availed himself of information which is so universally true as to be international in its character. Inevitably English practice prevails, but the American engineer will have little difficulty in translating amperes per square inch, for example, into current per circular mill.

Under power station considerable attention is devoted to the gas engine, for it is already demonstrated that this form of prime-mover soon will be, if it is not already, a serious competitor of the steam engine. Even the steam turbine receives a modicum of notice, although only one form of this machine is described.

Considerable space is devoted to illustrating the so-called "contact electric railway." This form is not as yet commercial and, therefore, a description of theoretical systems seems somewhat out of place in a practical handbook. A few estimates of costs are given, but in this respect, like all other pocket books, the volume is weak in a subject that is of paramount interest to the constructing engineer. The typography and general arrangement is an improvement upon the former volumes and leaves little to be desired.

BOOKS RECEIVED.

WIRELESS TELEGRAPHY. By Charles Henry Sewall. New York: D. Van Nostrand Company. 229 pages, 85 illustrations. Price, $2.00.

THE DYNAMO. By Hawkins and Wallis. New York: The Macmillan Company. Third Edition. 925 pages, 413 illustrations. Price, $3.00.

ELECTRIC LIGHTING AND POWER DISTRIBUTION. Vol. II. By W. Perren Maycock. London: Whittaker & Company. 690 pages, 407 illustrations. Price, 7s. 6d.

A HANDBOOK FOR THE ELECTRICAL LABORATORY AND TESTING ROOM. Vol. II. By J. A. Fleming. London: *The Electrician* Printing and Publishing Company. 622 pages, illustrated. Price, 14s.

ARITHMETIC OF ELECTRICITY. By T. O'Conor Sloane. New York: Norman W. Henley & Company. Sixteenth Edition. 162 pages, illustrated. Price, $1.00.

ELECTRIC TOY MAKING. By T. O'Conor Sloane. New York: Norman W. Henley & Company. Fifteenth Edition. 183 pages, illustrated. Price, $1.00.

The Murphy High Potential Interrupter.

BY A. FREDERICK COLLINS.

THE great value of an apparatus for producing rapid, successive and quickly-recurring interruptions and restorations of high potential electric currents has been known and appreciated by workers in many branches of the electrical industries. An exceedingly clever device, at once simple in construction and operation for effecting the interruption of heavy currents at high potentials, is the invention of Mr. Thomas J. Murphy, electrical engineer of the Compagnie des Tramways de l'Est Parisienne. The interrupter found its origin in the observation of the phenomena following when a heavy direct or alternating current of low or high voltage is conducted across an air-gap by a disruptive discharge.

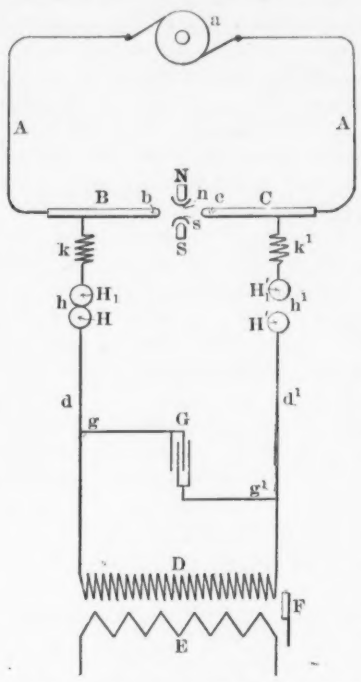


FIG. I.—DIAGRAM OF INTERRUPTER CIRCUIT.

By referring to the diagram, Fig. 1, it is self-evident that if a source of current, *a*, is connected in circuit with an air-gap, *b c*, having a greater length than the difference of potential will disrupt, no current will pass and therefore no arc will be formed; but if, on the other hand, a disruptive discharge from an induction coil or a frictional machine is made to take place between the terminals, *b c*, a momentary conductor is formed across the air-gap and the current from *a* will flow at that instant between *b c*, since the air insulation is broken down.

To prevent the current flowing continuously from *b* to *c* for an indefinite period after the initial resistance of the air has been broken down by the spark bridging the distance between the terminals, an electromagnetic blow-out is employed; that is, an electromagnet, *N S*, is mounted with its polar projections at right angles to the terminals forming the gap and thus a strong magnetic field is produced which reacts on the arc and disruptive discharge by extinguishing them and so interrupting the current.

The magnetic blow-out may be replaced by any other equivalent device, offering resistance to the passage of the current, such as a blast, *g*, of air, a jet of carbon dioxide or other gas, or an oil bath, etc. To prevent the deviation of the high-potential sparks from the induction coil, which take place between the terminals, *b c*, and impinging on the poles of the electromagnet, plates of mica or other dielectric are interposed in the path of the discharge and secured to the poles of the magnet.

The terminals or electrodes, *b c*, are continuations of the heavy current circuit, *B C;* these are made preferably of carbons arranged so that they can be adjusted to increase or decrease the length of the air-gap and a device is also included for regulating the distance between these electrodes automatically, a type of arc lamp mechanism or spring motor being employed for the purpose.

To insure good conductivity the electrodes or terminals joining the spark-gap are covered with a metallic sheathing, usually a coating of electrodeposited copper, and these are, in addition, protected by a sheathing of some highly refractory insulating material. To further insure absolutely uniform operation of the interrupter, the electrodes, together with their accompanying electromagnet, may be entirely enclosed in a vessel wherein a partial vacuum obtains.

There are several methods for producing the disruptive discharges between *b* and *c*. The one preferred by Mr. Murphy is shown in the diagram. The electrodes, *B C*, are connected to the terminals of the secondary coil, *D*, joining the high-potential circuit of an induction coil, the inductor or primary coil, *E*, supplying the interrupted e.m.f.; the oscillations in the secondary, *D*, may be regulated by means of an ordinary mechanical vibrating make and break, *F*, or, if desired, the induction coil may be replaced by an alternating-

current transformer and the disruptive discharge produced after the method of Fleming.[1]

In the method shown in Fig. 1, a condenser, *G*, having a suitable value is shunted across the circuit of the secondary coil, *g g'*. That portion of the high-tension circuit indicated at *d d'* has spark-gaps interposed as shown at *h* and *h'*; these are formed of metal spheres, *H H* and *H'H'*, and are also made adjustable. From the spark-balls, *H H'*, to the conductor electrodes, *B C*, the wires may be coiled as indicated at *K K'*, forming choking coils, although in practice it is not absolutely essential to include them.

The interrupter operates in the following manner: Assume that a current passes in the primary, *E*, of the coil, and that the mechanical vibrator of the induction coil is performing its function of making and breaking the current flowing in the inductor; also that the spark-balls, *H H'*, are separated in order not to have a closed shunted circuit between *d d'* by way of the main circuit, *A*, so that the potential in the secondary, *D*, may attain its maximum value; sparks will then pass through the air-gap, *b c*, without any untoward results being caused by the presence of the main conducting circuit, *A*, since the reactance of the section *A* will be so great that the difference of potential between the two conductors, *d d'*, will always equalize by way of *b c*.

Now, if the generator, *a*, sends a current into the circuit *A*, this current will traverse the gap, *b c*, along with the sparks, and there will be as many interruptions of the main current as there are oscillations in the secondary, *D*, of the coil. The function of the condenser, *G*, is to intensify the disruptive discharge, since in this case it is the condenser which is charged and discharged through the gaps, *h* and *h'*.

In certain cases Mr. Murphy has found it possible to eliminate the action of the vibrator of the coil and to produce the interruptions of the current in the secondary coil automatically, by the interruptions of the current in the principal circuit itself; it is then, of course, necessary to employ a suitable means for starting the principal current in the main circuit, which can be done by closing the gap, *b c*, by a fine fusible wire.

Like the choking coils, the condenser is very useful, but like them, also, it may be dispensed with, especially where the capacity of the secondary of the induction coil is found to be sufficient. If, oppositely disposed to the conditions indicated in the drawing, and if the secondary wires from *h* to *B* and from *h'* to *C* were straight, the arrangement of the sparking between *b* and *c* would be solely determined by the characteristics of the induction coil and condenser; but when these wires are coiled as choking coils are interposed, the oscillations of the current due to the secondary discharge may be modified by the presence of these coils, as is well known.

The fundamental claim to invention in this interrupter by Mr. Murphy is that of causing electric currents of high potential to be

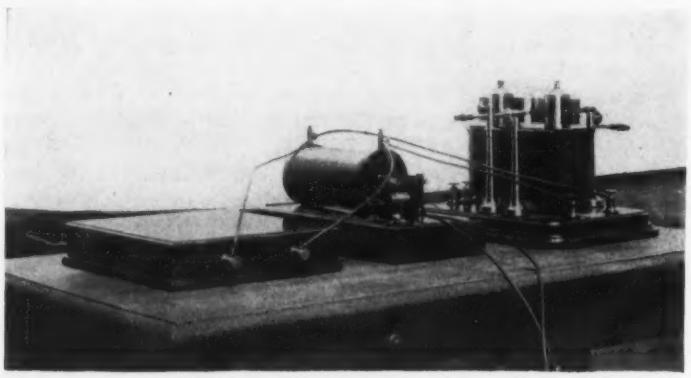


FIG. 2.—GENERAL VIEW OF INTERRUPTER.

conducted across an air-gap in the circuit of the current proceeding from a suitable source by passing successive oscillatory discharges through the non-conducting intervening space, so that the current passes during the duration of the spark, but ceases to pass between successive sparks as described above.

A curious effect noticed by the inventor in his earlier experiments was that until the critical e.m.f. and intensity of the condenser spark occurred, it was found that the main current would not follow the spark unless both were positive or both negative; that is, the main current preferred flowing in the same direction as the current from the induction coil which produced the disruptive discharge.

The duration of the main current appears to be prolonged and also the conductivity of the gap increased if the action between the field and the main current is such as to cause the arc to be blown downward. The Murphy interrupter has been operated on as high a potential as 500 volts direct current. At this voltage it gave forth a musical sound that was extremely painful to the ear. Under certain conditions, for example, when adjustments of the apparatus were made, the arcing and disruptive discharges combined results in loud explosions in the open air. The induction coil employed gave 45 mm. sparks with a condenser consisted of ten plates 12 cm. square. The interrupter of the induction coil has an especially high frequency of make and break, and is used with a storage battery of 14 volts; the interruptions are so rapid that even at this voltage there is practically no sparking at the contact.

There is a multiplicity of uses to which this new interrupter may be put, and one that has occurred to the writer is its utilization as a rectifier for alternating currents in accordance with the phenomenon observed by Mr. Murphy and stated above.

[1] Fleming's method consists of stepping up an alternating current to 25,000 volts which then charges a number of Leyden jars and these discharge through a spark gap.

Electricity in New Bridge Building Plant at Pittsburg.

The new plant of the American Bridge Company, at Ambridge, near Pittsburg, Pa., represents a total cost or investment of $5,000,000 with an output of about 24,000 tons of steel bridge per month. There are several features of interest in the large steam and electric generating power house and in the application of electric power about the shops. The boiler house contains two batteries, each with two Babcock & Wilcox 250-hp units equipped with an electric coal-hoisting and conveying apparatus and overhead steel and concrete hopper-bottom bins. This provides for a storage of 60 tons of coal, about sufficient for three days' supply, over each battery. The hoppers deliver to a Roney stoker under which there is a trench containing a hopper at each stoker in which the ashes are received and discharged, when convenient, into dump cars that deposit their contents in adjacent fills. The boiler house is large enough for as many additional boilers bringing up the capacity to 2,000 hp, estimated to be required for the plant here described; and it is capable of future extensions. The brick-lined steel smokestack is 8 ft. in diameter outside and 90 ft. high.

In the power house there are already installed two 300-kw Crocker-Wheeler generators and Erie City Iron Works compound engines. There is also one 100-kw Fort Wayne generator and one temporary 80-kw Gibbs generator operated by a standard Westinghouse engine. There is one Worthington compound 23 and 38 x 8½ x 24-in. pump for supplying water at 880 pounds pressure to the eye-bar and bending and forge shops. It is provided with two weighted accumulators 12 ft. in diameter and 18 ft. high. There is one 25 x 4½ x 15-in. Worthington pump for temporary distribution service and two 10 x 6 x 10-in. Dean pumps with 4-in. outlets to the buried 12-in. cast-iron fire main which encircles the yard. They are cross-connected so as to be interchangeable with the 7½ x 5 x 6-in. and the 6 x 4 x 6-in. Worthington duplex boiler feed pumps. There are two 500-hp Cochrane feed water heaters, and there is a small Worthington pump to return the drip from the hydraulic system which is stored in an overhead tank in the power house and returned to the suction pipe so as to secure the benefit of the grease contained in the water.

It is contemplated to eventually install one 500-kw General Electric generator and one 500-hp Reynolds-Corliss cross-compound engine, which has been ordered from the Allis-Chalmers Company. Room is reserved for two more generators and engines if necessary. After the Corliss engine is installed there will also be installed two Wheeler Engineering Company's surface condensers and air pumps, each with a capacity of 20,000 pounds of steam per hour. There are now in service two 14-in. Buckley jet injector condensers at the upper end of the 24-in. exhaust pipe above the roof. The plant is arranged so that the whole or a part of it can be operated as condensing, or the whole or part may supply exhaust steam for heating the shops. The building is served by one Pawling & Harnischfeger 60-ft., 25-ton girder crane which commands the entire floor area.

The electrical plant now installed develops 1,200 kw at 250 volts.

The generator mains are carried underground to the sides of the building and thence up to the gallery and in it to the east end, where they drop to the switchboard trench and distribute to the different generator panels. The current is measured through a total output panel on which there is a 16,000-amp. integrating wattmeter made by the General Electric Company; a 6,000-amp. ammeter and a voltmeter connected across the busboard, both of them Weston instruments. At present there are four 1,000-amp. distributing panels, each provided with a Weston ammeter. These panels are equipped with Cutter double-arm circuit-breakers. All the panels were built by Albert and J. M. Anderson, of Boston, and an additional 300-kw panel was built by the Walker Electric Company, of Philadelphia. Weston instruments and Cutter circuit-breakers are used throughout. The boards are made of polished slate 2 in. thick. The generator panels are 7½ ft. high and 2 ft. wide. The distributing panels are 18 ft. high and 7½ ft. wide and are arranged for extension in either direction. Circuits are carried through conduits from the switchboard pit to a pit in the bending and forge shop, thence up the wall to a wire cupola on the roof which is the center of distribution for the whole plant and from which the mains are run north and south to the various shops. They are carried over the yard cranes on bridges. The main bridge shop circuit consists of two 1,000,000 circ. mils lines and two 750,000 circ. mils lines, feeding the east and west sides, respectively. It is intended to carry the same load on separate cables for power and lighting and to use multiple and enclosed arc lamps throughout. The bridge shop cables are fire and water-proof and are carried through the center line of the shop on the roof trusses with outlets in iron pipe conduits on the vertical columns and in trenches from them to the machines. The drill and riveting gantries are operated under the Ward Leonard system controlled either from the gantries or from the riveting machine, and arranged so accurately that the gantries and riveter can be handled within a fraction of an inch. The hydraulic pumps in the bridge shop have air accumulators with automatic electric control operated by the movement of the accumulator. The bridge shop has 300 Toerring arc lamps, mostly suspended from the crane track girders. The lighting and current distribution in the eye-bar and bending shops correspond essentially with that in the bridge shop. Eye-bars are charged in the heated furnaces by machines using the Electric Controller & Supply Company's electro-magnet.

In the office building there are 727 incandescent lamps in the private offices and 131 arc lamps in the halls. Crocker-Wheeler motors are used for some of the eye-bar machinery and for the bridge shop gantries operated under the Ward Leonard system. Elsewhere all the motors are of the Westinghouse type, of 5 hp minimum size.

Arm for Telephone Transmitters.

The accompanying illustration is of a new arm for interior telephones, which is being introduced by the W. J. Barr Manufacturing Company, Cleveland, Ohio. It is of the rotary type, the cord being concealed. Neatness of design is one of its distinguishing features,

TRANSMITTER ARM.

and it is made of brass nickel-plated or of iron black-enameled. This arm, it is stated, has been adopted by several prominent manufacturers for hotel and interior work.

The W. J. Barr Company states that it is now manufacturing nearly 30 varieties of telephone arms and is supplying practically all of the leading manufacturers in this country, as well as several in European countries.

Arm, Pin and Bracket Convention.

The first annual convention of the National Arm, Pin and Bracket Association, convened on the evening of the 10th of November, at the Lookout Mountain Inn, Chattanooga, Tenn. The president being absent, Secretary J. B. Magers took the chair. The plan to regulate a uniform base on which to work and standardize the goods manufactured, was discussed. This took the greater part of the evening, after which the association adjourned to meet on the 11th at 11 o'clock.

At the second day's session, the meeting was called to order with E. J. Noblett in the chair. The first matter of importance was the election of officers for the ensuing year. The election resulted as follows: President, C. H. Houston, Chattanooga, Tenn.; vice-president, Daniel Ravenel, Franklin, N. C.; secretary, J. B. Magers, Madison, Ind.; treasurer, R. L. McOuat, Indianapolis, Ind.

Next in order was the appointing of the Executive Committee by the president, as follows: E. J. Noblett, Chicago, Ill.; A. A. Towers, Ellijay, Ga.; A. W. Bruner, Paoli, Ind. The other members of the committee will be appointed later by the president, who now has the matter under consideration.

It was decided to hold the next convention in St. Louis, Mo., in July, 1904. The Executive Committee was ordered to draft a letter to be sent to all supply dealers, stating the object of the association and requesting their co-operation in all matters pertaining to the standardizing of the articles manufactured by the various concerns interested in the movement.

They were also ordered to prepare resolutions which were adopted thanking the Chattanooga people for their hospitality to the members of this association. There being no other business to come before the convention, it adjourned to take a trip over the city and view Chickamauga Park.

Proposed Utilization of Falls of the Ohio River.

Our Indianapolis correspondent states that at the final conference between capitalists representing the Widener-Elkins interests and electrical experts and engineers employed by the syndicate and Major George McK. Derby, chief United States engineer for Indiana, it was announced that the plan for utilizing the falls of the Ohio River, near New Albany, to generate power for a vast electric system will be favorably recommended to Congress and the War Department. The project has been under consideration for some time. It was necessary, however, to secure the consent of the War Department to the plan and to demonstrate to Congress that navigation and certain riparian rights maintained by the government would not be impaired.

The Widener-Elkins people for the past three months have had engineers busy making plans and estimates to be presented to Major Derby. These plans are made with a view of being put into execution on the Indiana side of the river, a mile above the government dam.

It is proposed, by the plans, to widen the present mill race and extend it to the whirlpool eddy, a distance of one mile from the starting point. The power thus made available will be used for the generation of current. The wheels to be used are similar to some of those at Niagara Falls and the Chicago Drainage Canal. The engineers do not disclose the amount of power that may be secured, but say it will be on a large scale.

It is given out that if the final consent of the government is secured the promoters will spend at least $2,000,000 for the initial power plant, which will be of sufficient capacity to furnish electric light and power to Louisville, Cincinnati, Urbana and Indianapolis and cities and towns within a wide radius, covering parts of the three States—Indiana, Ohio and Kentucky. The plan is to organize a company and select directors from the traction companies now operating in Cincinnati, Urbana and Indianapolis.

Among those present at the conference besides a number of electrical experts and local citizens, were Dr. Louis Duncan, Massachusetts Institute of Technology; John Birkinbine, Philadelphia, engineer, and representing the United Gas Improvement Company; W. K. Schoepf, president Cincinnati Traction Company; Major George McK. Derby, United States engineer; Benzette Williams, Chicago, engineer, and Fred A. Joss, Indianapolis, representing the Terminal Traction Company.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Stock prices advanced and transactions were more active, due to covering by the extended short interest and to the favorable impressions created by the termination of the United States Steel conversion operation and the rise in Steel bonds and stocks. Outside participation was very narrow and dealings were mainly professional. The principal rise of the week was in the new Steel bonds, from 66 to 72, the preferred advancing from 50¼ to 53⅝, and the common from 10¼ to 12⅛. Pennsylvania Railroad was also a prominent stock in the transactions. Manhattan Railway showed strength in sympathy with the rest of the traction group, and General Electric developed advancing tendencies on small dealings due to investment buying. Amalgamated Copper was steady, but rather inactive. Boston reports a quiet market throughout the week. All of the electric and traction securities at New York, with one exception, closed with substantial gains and the business transacted in all was quite extensive. Brooklyn Rapid Transit closed at 38½ on transactions of 95,820 shares, a net gain of 1¾ points; the extreme quotations were 36¾ and 39⅝. Metropolitan Street Railway, after having dropped to 112, reacted and closed at 114½, this being 1 point under the highest price of the week and a net gain of 2¼ points. General Electric fluctuated between 148, the lowest, and 157½, the highest, closing at 155, this being a gain of 8¾ points. Westinghouse common closed with a net loss of 1 point, the last quotation being 137; preferred closed at 170. Western Union made a gain of 1¼ points, closing at 84¼. Following are the closing quotations of November 24:

NEW YORK.

	Nov. 17	Nov. 24		Nov. 17	Nov. 24
American Tel. & Cable	78	77	General Electric	149½	152⅜
American Tel. & Tel.	125	125	Hudson River Tel.	...	...
American Dist. Tel.	23	26	Metropolitan St. Ry.	114	115⅝
Brooklyn Rapid Transit	38¼	38⅝	N. E. Elec. Veh. Trns.	..	..
Commercial Cable	..	140	N. Y. & N. J. Tel.	..	..
Electric Boat	22	23	Marconi Tel.	...	...
Electric Boat pfd.	48	48	Western Union Tel.	83½	84¼
Electric Lead Reduction	*1	⅝	Westinghouse com.	136	137
Electric Vehicle	6	5½	Westinghouse pfd.	165	167
Electric Vehicle pfd.	8	8			

BOSTON.

	Nov. 17	Nov. 24		Nov. 17	Nov. 24
American Tel. & Tel	124¾	125	Western Tel. & Tel. pfd.	75	79
Cumberland Telephone	*115	*115	Mexican Telephone	1⅛	1⅛
Edison Elec. Illum.	*242½	241	New England Telephone	120	120
General Electric	149	152	Mass. Elec. Ry.	18	17½
Western Tel. & Tel.	7⅛	7¾	Mass. Elec. Ry. pfd.	76	76

PHILADELPHIA.

	Nov. 17	Nov. 24		Nov. 17	Nov. 24
American Railways	..	41	Phila. Traction	..	95
Elec. Storage Battery	46	47	Phila. Electric	5¾	5⅝
Elec. Storage Battery pfd.	..	47	Phila. Rapid Trans.	11⅛	11⅛
Elec. Co. of America	7¼	..			

CHICAGO.

	Nov. 17	Nov. 24		Nov. 17	Nov. 24
Central Union Tel.	..	..	National Carbon pfd.	85	87
Chicago Edison	..	..	Metropolitan Elev. com.	..	17
Chicago City Ry.	..	164	Union Traction	5¼	5
Chicago Tel. Co	..	..	Union Traction pfd.	25⅛	28
National Carbon	19	19			

*Asked

MICHIGAN TELEPHONE.—The protesting Michigan Telephone stockholders who are endeavoring to have set aside the recent foreclosure sale in Detroit, Mich., allege in their petition to the courts of that State that of the $5,000,000 capital stock outstanding $4,000,000 is held, owned or controlled by the American Telephone & Telegraph Company; $700,000 is held in the State of Michigan by 700 stockholders and these stockholders have no representation upon the board of directors. The property is valued at $12,000,000 and has an earning capacity of $2,000,000 annually, which is constantly increasing. From a report made at the annual meeting in June, 1903, covering the year of 1902, and made more than eight months after the bill of complaint was filed, it appears that the gross earnings were $1,549,331 and that the expenses were $1,632,230, showing an apparent deficit of $82,699. An analysis of the expense items is alleged to show that there was charged against earnings the sum of $394,521 as interest, which interest has not been paid. Expenses also include $480,000 under the head of maintenance, which is alleged to be a fictitious charge, and does not truly represent the amount so expended. It is alleged that instead of being insolvent at the time of the foreclosure mortgage, the company was amply solvent and had at all times sufficient money with which to pay said interest. The bill states that the number of telephones in the State is 53,000, and the company is now earning a sufficient revenue to pay 5 per cent. on its bonds and stocks and $1,200,000 for operating and $300,000 for maintenance.

CALIFORNIA TROLLEYS.—The actual consolidation of the electric roads H. E. Huntington has built and is to build in California with the Southern Pacific may never take place, but, according to advices from San Francisco, E. H. Harriman and Kuhn, Loeb & Co., of the Southern Pacific, have become large owners in the Pacific Electric Railway, of H. E. Huntington and I. W. Hellman, in Southern California. They are also to be close partners of Huntington in the electric systems he aims to build out from Stockton and Fresno and elsewhere in the State. The deal signifies that Harriman has prevented any combine between Huntington and Hellman and the Santa Fé in the south. On an agreed basis, the lines of the Southern Pacific, wherever they come into competition with the Huntington electric lines, are to work in harmony. In the San Joaquin valley a network of electric lines is to be built, but the Harriman and Huntington arrangement will prevent these lines from being a disastrous source of competition to the Southern Pacific.

MARYLAND TELEPHONE & TELEGRAPH.—The earnings of the company from October 1, 1902, to September 30, 1903, were:

Gross	$351,865
Expenses	155,159
Net	$196,706
Taxes, subway rental, interest on ground rent	28,426
Balance	$168,280
Interest on first 5s—$1,000,000 issue	50,000
Balance	$118,280
Interest on $1,155,000 general mortgage bonds	34,489
Surplus	$83,790

CUMBERLAND TELEPHONE.—The Cumberland (Bell) Telephone & Telegraph Company reports as follows: October gross, $292,340; expenses and taxes, $177,466; October net, $114,874; other income, $9,863; total income, $124,737; charges, $12,199; surplus, $112,538. The general balance sheet as of October 31, 1903, shows: Assets—Construction (exchange plants and toll lines) $14,172,286; supplies on hand, $241,440; real estate (exchange buildings) $527,330; stocks and bonds, $228,014; cash, $233,475; total, $15,402,545. Liabilities—Capital stock, $11,364,650; bonded debt, $1,046,000; debentures, $239,000; balance bills and accounts payable and receivable, $597,793; surplus, reserve and undivided profits, $2,155,102; total, $15,402,545.

AMERICAN RAPID TELEGRAPH BONDS.—The committee representing the old American Rapid Telegraph Company bondholders has distributed a final dividend of $2.55 per bond, upon the $2,894,000 bonds, which many years ago foreclosed upon the Rapid Telegraph Company property and sold the same to the Western Union Telegraph Company. This makes a total dividend distribution extending over several years of $265.55 per $1,000 bond. It was expected at one time that more than 30 per cent. would be realized, but the suit against the Western Union Telegraph Company, to recover rental previous to the sale was decided adversely.

BOSTON WEST END STREET RAILWAY.—The West End Street Railway Company, through its lessee, the Boston Elevated Railway, has petitioned the Railroad Commissioners for authority to issue its negotiable bonds to the amount of $700,000, the proceeds to be used in paying bonds of the Metropolitan Railroad and of the Middlesex Street Railway Company, both of which latter lines are leased to the West End Company.

BEAVER VALLEY TRACTION MORTGAGE.—The Beaver Valley Traction Company, which operates 15 miles of street car lines in Beaver Valley, has mortgaged its entire holding to the Northern Trust Company, of Philadelphia, for $3,000,000, and will use the money to extend the lines to meet the Pittsburg Railway Company's line at Corapolis and the New Castle Street Railway at Mahoningtown.

GENERAL ELECTRIC DIVIDEND.—The report that the General Electric Company is to declare an extra dividend of $2 per share at the next meeting is without foundation. The business of the company continues excellent, but there is no thought of distributing extra dividends at this time, even with large contracts in sight like that for the New York Central plant.

ANOTHER THIRD-RAIL ROAD.—It is stated that the Scioto Valley Traction Company, which is building from Columbus to Chillicothe, Ross County, will adopt the third-rail system. Its power house, at Valley Crossing, will cost about $400,000.

Commercial Intelligence.

THE WEEK IN TRADE.—Retail trade has been greatly stimulated over the larger part of the country by the cold weather, and as a result jobbing demand in seasonable lines has been quickened. It is noted that inquiries for holiday goods in some sections exceed last year's, the feature being the high grade of materials taken. Interior retailers, helped by favorable agricultural conditions, it is stated, are meeting their obligations more promptly. Farming interests are apparently in good financial condition. Southern conditions are especially good. Railway earnings continue in a very satisfactory state, the increase in gross receipts for the first half of November being 5½ per cent., while the net for September, exclusive of coal roads, advanced 4 per cent. Against these favorable developments is the situation in the labor world; the gloomy outlook for building, the closing down of some iron and steel mills, blast furnaces and leather tanneries, although others have started up again, and the continued hesitancy in the buying of practically all commodities. In the iron and steel market the general tendency is toward a lower price level. The exports of iron and steel were of moderate volume. A rapid increase in exports is expected, however, as the result of the cut of 33⅓ per cent. in railway freight rates. Twenty thousand tons of steel rails have been sold for delivery at Beirut, Syria, the quotation, it is reported, being under $19, at the Atlantic seaboard. The demand for anthracite coal is light and mining companies are restricting production in order to maintain prices. The output of bituminous coal is very heavy. The copper market relapsed into dullness, and home consumers hold off with orders. On the other hand, exports continued very heavy. Quotations are nominal, at 12½ to 13c. for Lake; 12⅜ to 12⅝c. for electrolytic; 12⅛ to 12⅜c. for cathodes and casting stock. Lead was reduced $6 per ton by the American Smelting & Refining Company, and, notwithstanding this cut, the market remains dull. The business failures for the week ending November 19, according to *Bradstreet's* statistics, aggregated 234 against 250 the week previous, and 201 the corresponding week last year.

CULTIVATING FOREIGN TRADE.—The Foreign Trade Association of America, organized to foster the growth of our export trade, has been incorporated under the laws of New York State, and a meeting to elect a temporary board of officers will be held at the rooms of the association at 66 Broad Street on December 1. The first regular meeting, at which permanent officers will be elected, will be held on the second Tuesday in January. The membership of the new association includes practically all the members of the old export club, and will number about 250. The following trades are represented: Hardware, paper, dry goods, glassware and crockery, shoes and leather, woodenware, light machinery, rubber goods, oil, paint and varnish, drugs and chemicals, electrical and structural machinery, iron and steel, groceries and provisions, lumber, agricultural implements and building equipment. A feature of the association's work will be its advisory board. When a trade attains a membership of five in the association it will select a committee of three, the chairman of which will be a member of the advisory board. This board's duty will be to recommend measures for the general benefit of the export trade. An arbitration committee, to adjust disputes without recourse to litigation, will also be a feature of the association. The association will hold its first annual dinner at the Waldorf-Astoria on December 16.

THE NEW RUSSIAN TARIFF is of interest on account of its increases; but we are not aware it has gone into effect yet. The unit of levy is the pood, or 36.112 pounds. Machines and apparatus, complete or incomplete, fitted together or in parts, of cast iron, wrought iron, or steel, with or without parts composed of other materials, even in combination with copper to an extent not exceeding 25 per cent. of the total weight of the machine, imported by the western land frontier are assessed 3.06 rubles ($1.58) in the new tariff, against 2.10 rubles ($1.18) in the present tariff. Gas and naphtha motors, steam engines, portable engines except those connected with complex thrashing machines and steam plows, locomotives, locomotive wagons, steam-driven tricycles and electrical locomotives, pumps and hand fire engines, compressors, and ice-making and refrigerating machines are assessed 4.38 rubles ($2.26) in the new tariff. On typewriting and sewing machines the new duty will be 5.58 rubles ($2.87). On all machines made of copper or its alloys, or in the composition of which copper or any alloy of copper is present in a proportion exceeding 25 per cent. of the total weight of the machine, the duty is raised from 6.48 rubles ($3.34) to 10.80 rubles ($5.56), an increase of $2.22. Dynamo-electric machines and electric motors of all kinds and transformers are raised from 2.10 rubles to 10.20 rubles ($1.08 to $5.25), an increase of $4.17.

MEXICAN HYDRAULIC PROJECTS.—Guillermo Brockmann, of Mexico City, who is largely interested in El Oro mines, and who handles considerable quantities of American machinery, has secured a concession to utilize the Rio de la Cienaga, in the vicinity of El Oro, for electric power. A company has been organized in Mexico City with an initial capital of $150,000, for the purpose of erecting the necessary plant. M. Marroquin y Rivera and Manuel Serrato, Mexico City, engineers, are primarily interested in a project to construct a plant on the River Conchos, between La Cruz and Julimco, for the purpose of generating current. Jesus Avalos, who owns a large plantation in the municipality of La Piedad, State of Michoacan, is to build a water power plant on the Lerma River. The plant will furnish power for operating sugar mills and lighting the villages in the neighborhood. Manuel Hernandez, of Santa Maria del Rio, State of San Luis Potosi, is the projector of a scheme to construct a large dam on the Santa Maria River, where a large plant is to be built and equipped with turbines. The water will be pumped to Santa Maria del Rio.

NOVEL USE FOR REFRIGERATION.—In some electrical tests where exact results are required, it is important that certain instruments, or baths, or chambers, be maintained at a constant temperature, and in other tests it is quite necessary that the air be comparatively dry. To secure these desirable conditions in its new laboratories at Eightieth Street and East End Avenue, New York City, the Lamp Testing Bureau has installed a refrigerating machine which will cool the air of one room to the temperature required and freeze the moisture from the air of another room when the humidity is higher than it should be for the best working conditions. The company hopes to have its new laboratories ready for work about January 1, when it will abandon its present temporary quarters at 14 Jay Street, New York.

PUEBLA LIGHT AND POWER NEGOTIATIONS OFF.—The negotiations looking to the taking over of the lighting and power systems in Puebla, Mexico, by Canadian interests have been declared off. A. E. Worswick, formerly chief engineer of the Mexico City electric traction system, who was conducting negotiations with the Canadian people, is now in Europe. Private advices state that Wernher, Beit & Co., of London, have been approached with a view to their taking up the matter. The Portzuelo Electric Light & Power Company is the name of the concern which furnished light and power for Puebla and vicinity. It operates a water power plant having a capacity of 4,000 hp.

ELECTRIC EQUIPMENT FOR POPOCATEPETL.—Mexican advices state that the death of Andrew H. Green, the "father of Greater New York," who was the leading interest in the American syndicate which recently acquired the Popocatepetl volcano, will not delay the construction work which the syndicate has in view. An electric railway is to be built up the mountain. The power plant will be installed on the adjacent volcano of Ixtaccihual. A. H. Smith and Captain Charles Holt, representing the American syndicate, are now in Mexico. The railway and power plants are expected to cost not far short of $1,000,000.

EQUIPMENT FOR SPAIN.—The Santamarina Company, of Barcelona, one of the prominent electrical engineering and contracting firms in Spain, is placing some fair-sized orders here for various equipment. The Spanish concern is represented in New York by C. J. Harrington, 15 Cortlandt Street. Some Wagner motors have just been ordered. Mr. Harrington has a good-sized order in hand for lamp supplies to be shipped to Buenaventura, Colombia. A substantial order for third-rail insulators has also been secured from the Brooklyn Heights Railroad.

HUDSON (MASS.) LIGHTING PLANT.—The town of Hudson, Mass., is now installing a General Electric 1,040-2,080-volt, three-phase generator, with a seven-panel blue Vermont marble switchboard. The generator is direct-connected to a Harrisburg cross-compound condensing engine, developing 375 hp at 125 pounds steam pressure, with 26-in. vacuum. The entire station has been overhauled and changed around into compact and convenient form and added to at an expense of $15,000 under the design and direction of Mr. W. G. Lawrence, manager.

EQUIPMENT FOR MERIDIAN TROLLEYS.—The Meridian (Miss.) Light & Railway Company is about to re-equip its rolling stock and will put six or eight new double-equipment 40-hp cars on in addition to eight already in operation which have been thus fitted; the apparatus being Westinghouse 40-hp motors and new standard General Electric controllers. The large new power house is nearing completion—said to be the largest in the State—and there is a likelihood that a steam turbine unit may be installed.

RAILWAY LIGHTING CONTRACT.—The United States Light & Heating Company has been awarded the contract for equipping all of the Empire State Express cars for the New York Central Railroad with its automatic system of electric lighting and ventilating; also cars for the Twentieth Century Limited.

BALL ENGINE ORDER.—The Chicago, Burlington & Quincy Railroad Company has ordered a direct-connected engine from the Ball Engine Company, Erie, Pa.

THE CITY OF SEATTLE, WASH., has let contracts for all of the equipment of the municipal electric light and power plant which is to be installed on the Cedar River. The first bids for the generators were thrown out and on the second set of bids the Bullock Electric Manufacturing Company was awarded the contract. The bids from all the competing companies were very close, being within $100 of each other on an $18,000 contract, and the Bullock Company, having the lowest bid, was given the order. The contract calls for two 1,200-kw, 2,300-volt, three-phase, 60-cycle, revolving field alternators with a speed of 400 r.p.m. and two 75-kw, 830-r.p.m. exciters. The power plant will operate under a head of 560 ft., the water being conveyed through 1,080 ft. of 48-in. steel riveted pipe. The Pelton Water Wheel Company, of San Francisco, has been awarded the contract for the water wheels and pipe. The station voltage will be raised from 2,300 to 44,000 volts by two banks of transformers (with a third bank for emergency), each bank consisting of three 400-kw transformers, and transmitted over two separate transmission lines to a sub-station in Seattle. Each line will be composed of three No. 1 copper or equivalent aluminum wires, spaced 75 in. apart, on poles approximately 125 ft. apart. At Seattle the current will be stepped down from 40,000 volts three-phase to 2,200 volts two-phase for power, incandescent lighting and arc and incandescent street lighting through constant-current transformers. John Martin & Co., of San Francisco and Seattle, have been awarded the contract for the transformers, the Standard Underground Cable Company, the contract for the wire, and the California Electric Works the contract for the insulators. The specifications were drawn and the engineering work on the plant is being done by R. H. Thompson, city engineer, of Seattle.

LOWER FREIGHT RATES.—The request of the steel manufacturers of this country for a reduction by the railroads of the freight rate on iron and steel products from interior points to the seaboard for export has been granted by the railroads at a long meeting which was held at the offices of the Trunk Line Association in this city. The reduction granted is 33⅓ per cent., and applies to all articles on the so-called special list, including billets, but not including steel rails. The latter, with a number of other articles, appear under the official classification list, and action on this list was referred to the so-called Iron and Steel Committee, which will meet in the second week in December to consider the application of the steel men. The new rate applies only to export business and carloads. Shipments of less than carloads remain under the old tariff. The old rate from Chicago to New York was $27.50 a hundred, or $5.50 a ton. The reduction of one-third brings this rate down to $17.50 a hundred or $3.50 a ton from Chicago. From Buffalo and Pittsburg to New York the rate was formerly $14.50 a hundred or $2.90 a ton, while the new rate will be $9.50 a hundred or $1.90 a ton. The same rates will apply via Boston, while the other ports will receive the usual differentials. The new rate will take effect December 1.

PRICES OF COAL have been cut for bituminous. Virginia, West Virginia and Maryland products are engaging sharply in competition with the cheaper products of Pennsylvania and elsewhere. The prices of George's Creek, Pocahontas and New River coals have been quoted in the last few days at $2.90 and $3.25. Previous to last week New River and Pocahontas coal was held stiffly at $3 to $3.25, and George's Creek coal 25 cents higher. A few weeks ago all these higher grade coals were held at $3.50 to $3.75, and even higher for some varieties. The first break was made last month, when the Executive Committee of the Bituminous Association abandoned the agreement as to the minimum prices. One cause of this action was the belief of certain high-grade producers that they had been engaged in a vain effort to maintain the market in the face of general slashing of the prices of the inferior grades. The falling off is not ascribed altogether to industrial dullness. It is explained that many consumers, having the big strike fresh in their recollection, and fearing another as a possibility, bought heavier stocks of coal than usual early in the present year and consequently do not require as much as usual now.

THE ELECTRIC STORAGE BATTERY COMPANY, of Philadelphia, has recently closed a contract with the Indiana Interurban Construction Company for the installation of a battery of Chloride accumulators for the Kokomo, Marion & Western Traction Company, at Kokomo, Ind. This battery consists of 288 cells, having a capacity of 384 kw, to be used in regulating the load on 60-cycle rotaries, so that the lighting and railway service can be obtained from the same generators. A contract has also been closed with the Department of Commerce and Labor at Washington, D. C., for two batteries to be operated by the National Bureau of Standards at Washington, with the Clark University at Worcester, Mass., and with the Bacon Air Lift Company for the residence of Hermon B. Duryea, Westbury, L. I. This latter installation consists of a battery of 68 cells, having a capacity of 46 kw to be used for lighting and power after the generator plant is shut down for the night.

BELL TELEPHONE OUTPUT.—The American Telephone & Telegraph Company instrument statement for month ended September 20, and since December 20, is as follows:

Month ended Sept 20:	1903.	1902.	1901.
Gross output	79,406	75,011	75,578
Returned	33,438	43,334	33,482
Net output	45,968	41,677	42,096
Since Dec. 20:			
Gross output	812,229	808,334	683,171
Returned	358,831	346,689	301,289
Net output	453,398	461,645	381,882
Total outstanding	3,603,718	2,987,251	2,334,698

SOME AMERICAN BALL ENGINE ORDERS.—The American Engine Company, New York offices White Building, Liberty Street, has secured a contract for three engines to be installed in the new dynamite factory under construction at Washburn, Wis., by the Atlantic Manufacturing Company. The plant will be electrically operated. There will be one 100-hp, one 120-hp and one 135-hp duplex compound engine to be belted to generators for light and power service. Another contract in hand calls for a 160-hp simple engine to be direct-connected to a Crocker-Wheeler generator of 100-kw capacity for lighting purposes in the Brooklyn plant of the American Can Company.

5,000-KW WESTINGHOUSE TURBO-GENERATORS.—A 5,000-kw type of Westinghouse turbo-generator is now under construction at Pittsburg, the first units of this type being built on order from the Philadelphia Rapid Transit Company, and the Pennsylvania Railroad Company, for the New York tunnel power plant. Unlike some of the recent Westinghouse turbines, the three sections of different diameter will be united in one frame. The speed will be 750 r.p.m. and three-phase currents will be generated at 25 cycles and 13,000 volts.

AMERICAN STEAM SUPERHEATER COMPANY, 176 Federal Street, Boston, Mass., has just issued its first catalogue illustrating and describing this specialty and discussing the practical advantages of superheat. The company has already begun to do business and reports orders for its superheaters from the Atlantic Mills in Providence, R. I., and the Nashua Light, Heat & Power Company, of Nashua, N. H. The first order is for use with a Westinghouse 400-kw turbine, and the second for three 500-kw General Electric turbines.

3,000-HP GAS ENGINE.—The Westinghouse Machine Company has completed the designs for a 3,000-hp gas engine, which will soon be put under construction. The machine will be of the horizontal type, and have two tandem cylinders, the pistons of which will connect with two cranks displaced 180°. As each cylinder will be double-acting a very uniform effort will be imparted to the shaft, this type being particularly well adapted for electrical generation.

MEXICAN WATER POWER SCHEMES.—Water power plants are to be built on the Scolapan river in the State of Vera Cruz and also at Tezuitlan, State of Pueblo, Mexico, for electric lighting and industrial purposes. Domingo Barrios Gomez, of Japantla, State of Vera Cruz, is the chief party concerned in both enterprises.

PLANT WANTED SOUTH.—The city of Sandersville, Ga., wants estimates on an equipment for lighting the town. The present figuring on the requirements are for 1,000 arc lights and 3,000 to 5,000 incandescents in a territory two miles square. All communications should be addressed to Mr. S. G. Lang.

THE AUTOMATIC ELECTRIC COMPANY, of Chicago, has received an order from Bills Brothers for complete equipment of an automatic exchange of 2,000 stations (initial installation) for Sioux City, Iowa. The exchange will have an ultimate capacity of 10,000 telephone stations.

QUIMBY PUMPS IN ENGLAND.—The Quimby Screw Pump Company, Limited, has been organized under the British Limited Liabilities Act for the purpose of manufacturing the Quimby pump in England. The capital of the company is $105,000.

ELECTRIC ROCK DRILLS FOR NEW ZEALAND.—The Denver (Colorado) Engineering Works have taken a contract for electric rock drills for use in New Zealand mines. The contract came through Muller, MacLean & Co., 116 Broad Street.

THE SAFETY INSULATED WIRE & CABLE COMPANY, of New York, has secured the contract for completing the fire and police underground cable work in Atlanta, Ga., for $2,819. The work was suspended recently owing to lack of funds.

STERLING AGENCY IN AUSTRALASIA.—The Sterling Electrical Manufacturing Company, of Warren, Ohio, has appointed Barre, Johnston & Co., of Sydney, New South Wales, as its Australasian agents.

General News.

THE TELEPHONE.

CECIL, ARK.—The Ozark & Cecil Telephone Company, of Cecil, has been incorporated with a capital stock of $5000. William Jones is president, W. G. Stockton, vice-president, and J. C. Wiggins, secretary and treasurer.

SAN DIEGO, CAL.—After a heated discussion in the City Council and its committees the Home Telephone Company has been granted a franchise to operate in the city.

ATWOOD, ILL.—The Atwood Mutual Telephone Company has increased its capital stock from $6000 to $9000.

TUSCOLA, ILL.—The Home Rural Telephone Company and the Tuscola Telephone Company have been merged.

NASHVILLE, ILL.—The Nashville City Council has granted a franchise to the Rixman Telephone Company of Irvington. The Southern Union Telephone Company which now operates a system in this city opposed the measure, but the objection was overruled.

EVANSTON, ILL.—Evanston is to have a new telephone line to compete with the Chicago Telephone Company. Business men and capitalists in the suburb are back of the plan. James E. Keelyn, who has organized similar companies at Waukegan, Racine and Kenosha, is at the head of the movement.

THOMASBORO, ILL.—Steps are being taken here to organize a farmers' mutual telephone company. Among those interested are J. E. Leonard, Thomas Leonard, Peter Murray, M. C. Busey, James Connett and Dr. T. J. Exton. It is proposed to build lines from Thomasboro to Leverette, and a branch will be extended northwest to connect with the South Tomlinson Telephone Company.

RICHMOND, IND.—The City Council has begun a movement to get the poles and wires of the telephone, telegraph, electric light and street car companies, now on Main Street, underground. The matter has been put in the hands of a special committee for investigation.

TIPTON, IND.—The Delaware & Madison County Telephone Company has secured an option on the Tipton Telephone Company. The local service has not been very satisfactory and if the exchange goes into the possession of the Delaware & Madison Company it will be rebuilt with an automatic switchboard and otherwise improved, thus insuring first-class service.

FINCHFORD, IA.—The Finchford Mutual Telephone Company has been incorporated with a capital stock of $10,000. Mr. W. W. Plantz is president.

WATERLOO, IA.—Four mutual telephone exchanges in Black Hawk County have combined and incorporated with a capital stock of $10,000.

OLDHAM, KY.—The Oldham Telephone Company has been incorporated with $10,000 capital stock by R. B. Blackmore, R. B. Cassady, Joseph Saber and others.

MT. STERLING, KY.—The East Tennessee Telephone Company has purchased several small companies operating in this section of the state. It will extend its system to cover every part of eastern Kentucky.

ANN ARBOR, MICH.—The Washtenaw Home Telephone Company has been granted a franchise in this city.

DIBLEY, MINN.—The Barnesville & Wolverton Telephone Company will build 35 miles of line through Mitchell and Atherton townships.

CANON CITY, MINN.—The Canon City Rural Telephone Company has been formed here to build a line from this city to Faribault. Mr. H. H. Crossett is president.

INDEPENDENCE, MO.—The American Electric Telephone Company, of Chicago, recently made shipment of a 3000 capacity common battery type, mahogany cabinet multiple switchboard and exchange equipment to Independence, Mo. This switchboard is equipped complete for four-party selective signaling system. The power plant includes machinery necessary for handling the party line service.

ARMSTRONG, MO.—The Farmers' Telephone Company, composed of farmers of Burton and Prairie townships, has been organized by the election of the following-named officers: Asa Thompson, president; William Forbes, treasurer, and Bert Blousett, secretary. Seventy-five farmers are stockholders in the company and work is rapidly progressing in the erection of lines. This company will have connections with all the towns in Howard County.

WEST POINT, NEB.—The Ainsworth Telephone Company, under the management of Mr. Joseph F. Jankele, is putting in a local telephone system.

FREMONT, NEB.—Representatives of the independent telephone companies of eastern Nebraska to the number of 30 met on Nov. 10 and formed the Nebraska Independent Toll Line Association. The following-named officers were elected: President, I. D. Clarke, Papillion; secretary, J. Howard Heine, Hooper; auditor and treasurer, W. D. Crist, Fremont. Rate committee: A. M. Munn, Nebraska City; O. M. Thorp, Wahoo; T. H. Pollock, Plattsmouth; J. C. Killarney, Auburn; A. E. Gantt, Falls City.

LIBERTY, N. Y.—The Liberty & Jackson Telephone Company, of Liberty, Tioga County, has been incorporated; capital, $5000.

BABYLON, L. I., N. Y.—The village trustees have granted a telephone franchise to the New York & Long Island Telephone Company.

GALWAY, N. Y.—The Galway Telephone Company has been incorporated with a capital stock of $5000. Mr. C. F. Mairs is one of the directors.

EDEN, N. Y.—The Eden Telephone Company, of Eden, Erie County, has been incorporated; capital, $3000. Directors: D. A. Palmerton, Y. C. Barto and J. D. Caskey, of Eden.

NEWBURGH, N. Y.—The quarterly meeting of the Orange & Sussex County Independent Telephone Association was held recently at Newburg. The committee in charge of issuing the new book of subscribers reported the work well under way. A connecting line to Albany is nearly completed.

DRYDEN, N. Y.—The Dryden Telephone Company has been incorporated here with a capital of $10,000. The incorporators are Edwin C. Dedrick, Webb Corbin and Alfred Myers, of Dryden.

BUFFALO, N. Y.—The Commercial Telephone Company, of Gowanda, has been incorporated to operate in Erie and Cattaraugus Counties; capital, $50,000. Directors: E. C. Fisher, Gowanda; B. H. Phillips and E. L. Falk, Buffalo.

CINCINNATI, OHIO.—The Pataskala & Hebron Telephone Company has been incorporated with a capital stock of $65,000.

BROOKVILLE, OHIO.—The Brookville Telephone Company has increased its capital stock from $6000 to $10,000. J. C. Snyder is president.

PEMBERVILLE, OHIO.—The Pemberville Telephone Company has bought the interests of the Bradner Telephone Company in the Bell exchange. The new company will rebuild the plant and install new telephones.

CROOKSVILLE, OHIO.—The Crooksville Telephone Company has been incorporated with $10,000 capital stock by J. C. Moore, S. M. Winn, T. F. Wilson, J. B. Rhodes and others to build a local telephone system.

CINCINNATI, OHIO.—According to Cincinnati dispatches the local Bell Telephone Company's name has been changed from the City & Suburban Telegraph Association to the Cincinnati & Suburban Telephone Company.

ELMORE, OHIO.—The stockholders of the Ottawa County Telephone Company have reelected the present officers and declared the usual semi-annual dividend. E. O. Harkness is president. A number of improvements are being arranged for.

TOLEDO, OHIO.—Regarding a rumor that the Postal Telegraph & Cable Company had secured control of some independent telephone lines in Ohio, denial is made by local officials. It was explained that a telephone company desired the joint use of a number of poles, offering in return the free use of a test station for the telegraph company in a nearby town. The telephone company also offered to telephone messages to a few towns on this route where the telegraph company would not locate offices for the want of sufficient business.

WHITE EAGLE, OKLA.—The Reservation Telephone Company of this place has been incorporated with a capital stock of $5000. Mr. G. W. Carsen is one of the directors.

EASTON, PA.—The Easton & Bethlehem Telephone Company is being formed here. Mr. J. D. Broadhead is president.

PATTON, PA.—The Huntingdon & Clearfield Telephone Company is extending its lines and is now building 40 miles of trunk line from Patton to Clearfield.

VANDERGRIFT, PA.—The telephone system at this place, with 200 subscribers, is operated by the Vandergrift Electric Light & Power Company. The subscribers pay $1.50 and $2 a month.

LAKE VIEW, PA.—Mr. F. E. Benson, secretary of the Northeastern Penna. Telephone Company informs us that his company gives free use of its lines to all stockholders, and that it is maintained by tolls collected from non-stockholders. Each stockholder pays $2 per year. The company has at present 500 subscribers. During the past year it has added 30 miles of toll lines.

SPARTANSBURG, S. C.—It is announced that two additional copper metallic circuits will be strung between Selma, N. C., and Spartansburg, S. C., by the Southern Bell Telephone Company.

ROCK HILL, S. C.—A subscription list of 354 is the record of the Rock Hill Telephone Company. General Manager J. E. Pryor informs us that possibly the company may install the central energy system next year. The company is at present building a 30-mile line.

SUMTER, S. C.—The Sumter Telephone Company is moving into new quarters and is changing its system from ground metallic to full metallic circuit. The company has 320 subscribers, with 300 miles of toll line. It uses apparatus of the Telephone Manufacturing Company and the Sumter Telephone Manufacturing Company, and reports a steady growth.

DENTON, TEX.—The Home Telephone Company will build lines throughout the county for the use of farmers.

PETERSBURG, VA.—The Petersburg Telephone Company has begun to build a line from this city to Chesterfield Courthouse, and will complete it during the month. Petersburg is now in telephone communication with Dinwiddie, Prince George, Surry, Isle of Wight and Nansemond. The lines are rapidly being built to various points around the city, and within two years there will not be an important point in Southside Virginia that will not be connected by telephone with Petersburg. As soon as the line to Chesterfield has been completed the company will build a line to Mecklenburg, Va.

MILWAUKEE, WIS.—The West Shore Telephone & Telegraph Company has applied for a franchise in this city.

HUSTISFORD, WIS.—The South Hustisford Telephone Company, of Hustisford, Dodge County, has been incorporated with a capital stock of $300. The incorporators are W. H. Jones, E. C. Randell, E. E. Randell, S. B. Jones and H. O. Ryder.

CIUDAD PORFIRIO DIAZ, MEX.—An extensive telephone system is to be built in this district which borders on the Rio Grande. It will be under governmental control and a tax has been levied to meet the cost of construction. The lines of the proposed system will extend to all of the principal towns and larger ranches in the district.

OTTAWA, ONT.—The organization of the Canadian Telephone & Telegraph Company has been completed. The total capital is $1,000,000. Ottawa will be the headquarters of the concern, and if it can get a franchise from the Council of this city it will begin the construction and installation of its system forthwith. It is empowered to build trunk lines, and ultimately hopes to see its system stretching across the continent.

ELECTRIC LIGHT AND POWER.

OZARK, ALA.—Bonds amounting to $15,000 have been sold for the installation of an electric light plant.

FORDYCE, ARK.—The Fordyce Light & Water Company has been incorporated with a capital stock of $20,000, of which $6250 has been subscribed. B. H. Woods is president and treasurer, J. G. Pattillo, vice-president, and John Hampton, secretary.

YREKA, CAL.—The Siskiyou Electric Company has applied for an electric franchise in this city and bids for said franchise will be received Nov. 27. J. F. Brown is City Clerk.

TRINIDAD, COL.—Press despatches from Trinidad state that on the morning of Nov. 10, dynamite was exploded under the electric power house at Hastings, 20 miles north of Trinidad. No damage was sustained to the machinery, though one corner of the building was destroyed. It was thought to have been the work of some sympathizer with the strike in the mining camps.

SILVERTON, COL.—The fight which has been on here the past two years between the independent electric light company and the municipal plant is about to culminate in disaster to the independent company. At present incandescent lights are furnished to consumers by each plant at a rate of about $1 per light. This rate is about to be still further reduced. The city council has decided to levy a tax upon property owners for the maintenance of the city electric plant and furnishing lights to all without any direct charge therefor. It is estimated that lights can thus be furnished at a cost of not to exceed 50 cents each per month. This move, it is said, will effectually do away with the independent plant, as its owners cannot maintain their business and provide lights at a lower rate than is now in force.

IDAHO FALLS, IDA.—A company recently organized here contemplates establishing an electric power plant on the Snake river. The estimated cost is $75,000.

BOISE, IDA.—It is stated that the Mercantile Trust Company, of Boston, has filed in the United States Court here a bill for the foreclosure of a mortgage against the Boise-Payette Electric Power Company. The mortgage covers $475,000 of bonds issued by the company. The court will be asked to appoint J. W. Cunningham, secretary of the Capital Electric Light, Motor & Gas Company, as receiver to take charge of the company. The Boise-Payette Electric Power Company, it is stated, has defaulted in the payment of its semi-annual interest amounting to $13,250. Later reports are to the effect that the Court has appointed Mr. Cunningham as receiver.

MARSHALL, ILL.—The Marshall Heat & Light Company has been incorporated to operate heat, light and power plants; capital, $15,000. Incorporators: Fred J. Bartlett, Harry B. Dulaney and Walter Cole.

JERSEYVILLE, ILL.—The Union Water, Light & Traction Company has been incorporated; capital, $50,000; to operate power, light, heat, water and railway plants. Incorporators: Owen Ford, J. M. Gore, B. V. Beekman.

STERLING, ILL.—The City Council will increase the price of electric lighting on Dec. 1. To those using their own meters the price will be raised from 11c. to 13c. per kilowatt, and to those using city meters from 12c. to 14c. per kilowatt. Discounts will be allowed for prompt settlement of bills.

LA GRANGE, ILL.—The La Grange water works plant, which also houses the electric light plant from which water and light are supplied to that village and to Grossdale, was destroyed by fire on Nov. 18. The electric light plant will be placed in operation as soon as second-hand machinery can be secured to tide over until such a time as new machinery can be obtained. In the meantime the village streets will be in darkness.

FT. WAYNE, IND.—The County Commissioners have authorized Engineer Reilling to prepare plans for an electric light plant for the poor farm, to cost about $3,000.

EAGLE GROVE, IA.—The citizens have voted to grant a franchise to the Eagle Grove Light & Heating Company.

MILO, ME.—Dr. H. A. Snow, F. E. Guernsey and W. S. Owen, are interested in the construction of an electric plant here, to cost about $15,000. C. O. Sturtevant is the engineer.

FAIRFIELD, ME.—The power house of the Waterville & Fairfield Electric Railway & Light Company, used for the incandescent system of lighting, was burned recently. The loss on the machinery was about $6000, covered by insurance. Loss on the building was slight.

LAWRENCE, MICH.—The citizens have voted to issue $15,000 electric light bonds.

CAPAC, MICH.—Bids will be received Nov. 30 by the Board of Village Trustees for furnishing a 135-hp horizontal automatic engine, to be direct-connected to, or to drive by belt a single-phase, 60-cycle, 2,300-volt, 90-kw alternator. John Hewitt is chairman.

MINNEAPOLIS, MINN.—Franchise negotiations with the General Electric Company are under way. The corporation has consented to accept a gross earnings tax in addition to all other state, city and county levies, and not in lieu thereof. It is also willing to have its meters inspected and its lamp efficiency tested at regular intervals by city officials. The company does not object to a rival concern, but says it is unwilling to consent to a franchise which carries with it the legal power of any private plant to light the structures nearby.

VERSAILLES, MO.—The citizens of this place have voted bonds to the amount of $10,000 for the purpose of erecting a city electric light plant.

HANNIBAL, MO.—The municipal board of Hannibal has retained the Arnold Electric Power Station Company, of Chicago, to advise as to necessary changes and the replacing of the old system by a modern one in the near future.

JOPLIN, MO.—The United States Supreme Court at Washington has decided the case of Joplin City against the Southwest Missouri Light Company in favor of the city. The case involved the right of the city to erect lighting works of its own, to be operated in competition with those of the light company.

BILOXI, MISS.—The deal has been closed and the deed signed transferring the assets of the Biloxi Electric Light Company to the Biloxi Electric Street Railway & Power Company. The consideration was $29,500 in cash and $18,000 in stock.

NEW BRUNSWICK, N. J.—The Public Service Corporation of Newark has purchased the Central Electric Company plant here, which supplies this city, Metuchen, Bound Brook, Perth Amboy, Woodbridge and Rahway with light. The company purchased the business, paying $17 per share for all the stock.

SYRACUSE, N. Y.—The Syracus_ Lighting Company is to expend $30,000 in equipping its plant with stokers.

HICKSVILLE, L. I., N. Y.—The Nassau Electric Light & Power Company, of Roslyn, has secured the contract for furnishing 50 street lights, at $15 per light per year.

NEW YORK, N. Y.—The Bradley Universal Heat, Light & Power Company, of New York City, has been incorporated; capital, $100,000. Directors: F. D. Lyon, H. A. Bradley and Benjamin Patterson, of New York City.

MALONE, N. Y.—The Fort Covington Light, Heat & Power Company, of Malone, has been incorporated to manufacture electricity; capital, $12,000. Incorporators: Patrick Keefe, Mida M. Keefe and John O. Weeks, of Malone.

ROSLYN, L. I., N. Y.—The Nassau Light & Power Company, of Roslyn has purchased property at Glenwood, and will remove to this site the plant now located at Roslyn. It is proposed to erect a plant double the capacity of the present one.

BATAVIA, N. Y.—The stockholders of the Consolidated Gas & Electric Company have voted to increase the capital stock of the company from $200,000 to $300,000. Only a portion of the authorized increase of stock will be issued at present. Subscriptions for $25,000 worth at par, $100 a share, have been received.

TROY, N. Y.—It is stated that the Hudson River Electric Power Company has purchased a site, and will soon commence constructing a transformer station and office building. The intention of the company is to furnish power to Troy by means of a cable laid along the bed of the river from Watervliet to Troy.

NEW YORK, N. Y.—The West Side Electric Company is preparing to fight the New York Gas & Electric Light, Heat & Power Company. The West Side Electric Company has obtained a decision from the Appellate Division of the Supreme Court making permanent the injunction which it had obtained ensuring it the use of conduits. The concern will now place its wires in the conduits and proceed to do business.

LIDGERWOOD, N. D.—A franchise for a water and light plant is stated to have been granted to Ralph Maxwell.

VALLEY CITY, N. D.—A. H. Gray, of Valley City, has bid $20,500 for the purchase of the city plant, including a 20-year franchise to be paid in street lighting.

HAMDEN JUNCTION, OHIO.—The citizens have voted to issue bonds for an electric light plant.

CORTLAND, OHIO.—The village is desirous of securing a lighting plant. A proposition was made by the Warren Electric Light & Power Company to string its lines to the town, but the company decided that it would not pay.

MILTON, ORE.—It was voted to issue $27,000 bonds, of which $12,000 will be used for improvements to water works and electric light plant.

EAST McKEESPORT, PA.—The question of issuing $10,000 electric light bonds is under consideration.

MYERSDALE, PA.—The Borough Council has instructed the Light Committee to prepare plans and secure bids for a municipal electric light plant.

SHIPPENSBURG, PA.—The Shippensburg Electric Light Company and the Shippensburg Gas Company will hereafter be operated under one management for the purpose of reducing expenses and improving the service.

OIL CITY, PA.—Councils have refused the application of the Central District & Printing Telegraph Company to install a conduit system in this city. The company is now operating without a franchise, but will rebuild its overhead system at an expense of $12,000.

BRENHAM, TEX.—An electric light plant will be installed in the Brenham cotton mill.

LAMPASAS, TEX.—It is reported that the capacity of the electric light plant here is to be increased.

AUSTIN, TEX.—The municipal electric light and water works plant here are to be enlarged. The city water and light commission can give information.

COLUMBUS, TEX.—John A. Cook and Sealy B. Moody, of LaGrange, Ill., contemplate establishing a large electric power plant near here. It is proposed to construct a canal 1000 yards long from the Colorado River, which will afford a waterfall with a height of about 18 feet. The electrical energy generated by this plant is to be used for the operation of irrigation, cotton mill and flour mill machinery. Messrs. Cook and Moody represent a syndicate of capitalists who are ready to invest in the enterprise if the report is favorable. A survey is to be made with the view of determining the cost of the project.

SPOKANE, WASH.—Mr. P. Johnson, of this city, and other local capitalists have arranged for the installation of an electric lighting plant at Troy, Ida.

LEON, MEXICO.—J. S. Martison, representing a syndicate of Chicago capitalists, has been investigating the situation in this section with the view of establishing a large electric power plant near here, the power thus generated to be utilized by industrial concerns of this city.

OSHAWA, ONT.—The contract for an electric light plant has been awarded to Thos. N. Deverall, for $5,115.

THE ELECTRIC RAILWAY.

SANTA ROSA, CAL.—The Santa Rosa Railway Company has been incorporated here to build an electric railway between Santa Rosa and Petaluma, connecting with Sebastapol and Forestville. It is stated that all the rights of way have been secured and that work will commence soon. The company is capitalized at $1,000,000, and Frank A. Brush, Alfred D. Bowen, Thomas Archer, Francis Cutting, Charles Towne, L. T. Wagner and Alfred G. Sheath are stockholders. Burke Corbet, of San Francisco, is treasurer.

COLORADO SPRINGS, COL.—The announcement is made by General Manager C. W. Wells that the Pike's Peak cog road is to be operated by electric power. Mr. Wells states that negotiations have already been entered into with the Pike's Peak Hydro-Electric Power Company to furnish electrical energy for the operation of the road next season. General Manager Wade, of the power company, is authority for the statement that trolley cars can be operated successfully above an elevation of 12,000 ft., and that with proper apparatus the electrical storms abounding on and around the summit of the peak during the summer months will have no effect on the operation of the road by electricity.

SPRINGFIELD, ILL.—Articles of incorporation for the Freeport-Dixon Electric Railway Company, with principal offices at Freeport, and a capital stock of $50,000, have been filed. The incorporators and first board of directors are O. T. Smith, F. W. Siecke, W. A. Hance, Boyd P. Hill, C. F. Hildreth, R. P. Eckert and F. A. Read, all of Freeport.

CHICAGO, ILL.—The strike of the employees of the Chicago City Railway continues and the prospect of an agreement between the contending forces seems to be as remote as ever. On November 19 all the drivers, including "tow-boys" at the cable barns and wrecking wagon drivers, joined the strike. Efforts were made by Mayor Harrison and a committee of mediation to find a common ground on which all the interests concerned might meet, but after a three-hours' session no results were attained. A session of the joint conference was held on the 20th, and it looked as if the basis for a settlement had been reached, but all the plans failed eventually. The company has determined upon a fight which shall end only when the union employees have surrendered. The company has issued a peremptory demand that the strikers who went out on Nov. 12 surrender their badges and other property belonging to the corporation. They are then to receive the money due them for work done previous to the beginning of the strike. Cars are being run on four of the trunk lines of the company, and at last reports were meeting with little interference. Both sides have, according to the latest advices, declared their determination not to yield a single point.

ANDERSON, IND.—The Council has granted Wallace B. Campbell, of this city, a fifty-year franchise into or through this city. The proposed road will connect Anderson, Noblesville and Lebanon.

NEWCASTLE, IND.—The Indianapolis, Newcastle & Winchester Traction Company has been incorporated, with $100,000 capital. The officers are B. F. Koons, of Moorland, president; E. L. Watson, of Winchester, vice-president; C. S. Hernly, of Newcastle, secretary; Daniel E. Storms, of Indianapolis, treasurer.

RICHMOND, IND.—Announcement is made that the Columbus, Greensburg & Richmond Traction Company has disposed of its bonds in New York. The amount of money realized from the first bond issue is about $2,500,000. A preliminary survey of the line is to be made as soon as the general course of the route is determined upon.

DES MOINES, IA.—The Des Moines & Missouri Railway Company has filed articles of incorporation. The road will extend from Des Moines southwest. The capital stock is $50,000. George G. Wright, G. M. Garver, George Elmore, J. A. Garver, Jr., Leland Windsor, A. R. Bemis, F. H. Hunter, M. H. Wilson are the incorporators.

LEXINGTON, KY.—The interurban electric railway between Lexington and Paris, Ky., owned by the Blue Grass Traction Company, is now in operation.

LOUISVILLE, KY.—The Commissioners of Harrison County have granted a right of way to the Leavenworth Electric Railway Company. The company is to construct and operate an interurban line between Leavenworth, New Albany and White Sulphur Springs. Thomas P. Elsworth, of Leavenworth, is president of the company, and S. A. Beals is secretary.

AUGUSTA, ME.—Surveys have been completed for the electric railway from Camden to Belfast. The distance is 18 miles. It is proposed to construct the line during 1904. W. B. Getchell, of Augusta, is chief engineer.

LEWISTON, ME.—The articles of association for the Lewiston & Kennebec Street Railway have been approved by the State Railroad Commissioners, and the survey of the road is to be begun early in the spring. The road will run from Lewiston to Sabatis. The incorporators are Sidney M. Bird and Maynard S. Bird, of Rockland; George W. Heselton, of Gardiner; John D. Clifford and Charles C. Benson, of Lewiston, and Edward W. Gross, of Auburn.

WESTFIELD, MASS.—The Woronoco Street Railway Company is building an addition to its power station in Westfield. Two new engines are being installed. A 325-kw generator will complete the equipment.

BOSTON, MASS.—It is announced by the officials of the Boston & Albany Railroad that the Newton Lower Falls branch will soon be operated by electricity, the power to be furnished by the Watertown & Newton Electric Lighting Company. This branch is about 11 miles long, and runs from Riverside to Newton Lower Falls.

BOSTON, MASS.—The Horse Neck Beach Street Railway Company has been incorporated at the office of the Secretary of State, with a capital stock of $200,000. The board of directors consists of Benjamin W. Carlow, Henry L. Brett, Artemas S. Pennock, Alvin F. Waite, Ben. T. Smith, Philander H. Brightman and E. G. Gifford.

SPRINGFIELD, MASS.—The Springfield Street Railway Company is completing the installation of machinery which will double the capacity of its power plant. A 3000-hp engine has been installed and a battery of boilers is being put in which, when completed, will furnish 3500-hp. A 2000-kw General Electric generator completes the new equipment.

GRAND RAPIDS, MICH.—Surveys have been completed by the Grand Rapids & Southern Michigan Traction Company for its proposed line running from Kalamazoo to Grand Rapids. This company was organized some time ago, with a capital stock of $1,300,00.

DETROIT, MICH.—Henry P. Wickham, of Detroit, has bought the franchises and grade of the Union Traction Company in Genesee County at sheriff's sale. It is said that he will probably transfer them to the Nester-Russell-Tarsney syndicate, which is planning an electric railway from Saginaw to Flint.

NASHUA, N. H.—The connecting link in the electric railway service between Concord and Boston will be begun next Spring. A mortgage has been received at the office of the City Clerk by which the Goff's Falls, Litchfield & Hudson Street Railway conveys to the American Loan & Trust Company, of Boston, all real estate and other property it may acquire to secure $300,000 in 5 per cent. gold bonds. It is understood that this amount will be used to equip the road.

WOODSFIELD, OHIO.—The Barnesville & Woodsfield Electric Railway Company, of Barnesville, has been incorporated, with $25,000 capital stock. The line will open up territory not reached by either steam or electric roads.

LIMA, OHIO.—The Western Ohio Railway Company has finished its line from Lima to Piqua, Wapakoneta to St. Marys, Celina, New Bremen and Minster, a total of 78 miles. Service was inaugurated Nov. 1. Arrangements are now being made for running cars direct from Lima to Dayton without change.

LANCASTER, PA.—A preliminary survey has been made of the proposed Lancaster & Southern Electric Railway.

LEBANON, PA.—Surveys have been completed and right of way obtained for the proposed electric railway between Palmyra and Valley Glen Park.

JOHNSTOWN, PA.—It is stated that work is to be commenced by Feb. 1 on the projected Conemaugh Valley Street Railway to connect this city and Ebensburg. The line will run via South Fork, Maple and Wilmore.

BLOOMSBURG, PA.—At a recent meeting of the Bloomsburg Town Council an ordinance was passed granting the Danville & Bloomsburg Electric Railway entrance to the town. The new road will be ten miles long, extending from Danville to Bloomsburg. The entire right of way has been obtained by the company, and work will be begun by the contractor next spring.

SUNBURY, PA.—Surveys for the extension of the Shamokin Extension Electric Railway Company through Irish Valley to a connection with the lines of the Sunbury & Northumberland Electric Railway on Second Street have been completed. The line will run via Augustinville and Seven Points, and nearly all the right of way has been secured. Track laying will be commenced about April 1.

WAYNESBORO, PA.—Surveys are being made for an electric railway between this city and Hagerstown, Md., connecting the lines of the Chambersburg, Greencastle & Waynesboro and Hagerstown Electric Railway systems. The line will be about 11 miles long, and the cost of building and equipping will be borne jointly by Pennsylvania and Hagerstown capitalists. The building of the Chambersburg, Greencastle & Waynesboro line has almost reached Greencastle.

WELLSBORO, PA.—A public meeting in the interests of the proposed electric railway between Wellsboro and Elmira, N. Y., was held here. H. M. Rhymer, of Elmira, the chief promoter, states that the cost of construction will be about $1,000,000. It is intended that people living along the proposed route take about $200,000 worth of stock. After the completion of the main line branches from Covington to Blossburg, 6 miles, and from Sullivan to Troy, 9 miles, will be considered.

DOWNINGTOWN, PA.—The West Chester Street Railway Company now obtains all the power for operating its cars in West Chester from the power house in this borough. Formerly power was leased in West Chester. With the completion of the Lenape power house the company will have three power houses within 13 miles of West Chester—Downingtown, Coatesville and Lenape. The site for the new power house at Lenape has been changed slightly, and water for the boilers will now be drawn from the Brandywine Creek.

YORKTOWN, VA.—The extension of the lines of the Newport News Railway & Electric Company to Yorktown is about to materialize.

OSHKOSH, WIS.—The Common Council has passed an ordinance granting a franchise to the Fond du Lac & Oshkosh Electric Railway Company. The franchise provides that the company pay to the city $35,000 in instalments of $1000 per year. The company has agreed to pay $21,000 in instalments of $500 a year.

VICTORIA, B. C.—G. H. Gray, of Victoria, is surveying for a mono-rail railway, which a syndicate of Minneapolis capitalists proposes to build. The route will be up Hall Creek, Upper Duncan and the west fork of the Lardeau, all in the Lardeau-Duncan district.

LONDON, ONT.—The deal between the Southern Traction Company and the English syndicate which is financing the scheme to build an electric railway has been closed and the money placed at the disposal of the local company.

WALKERVILLE, ONT.—The Ontario Traction Company, of Walkerville, Ont., has taken out papers of incorporation to construct an electric railway from Windsor to Chatham, Ont., through Walkerville, and surveys will be made at once. The incorporators are Willis F. Brown and F. M. Ohl, of Toledo, Ohio, with C. M. Walker, E. F. Ladore and J. H. Cobum, of Walkerville, Ont., Canada. Willis F. Brown, of Toledo, Ohio, is general manager and chief engineer.

NEW INDUSTRIAL COMPANIES.

THE RECIPROCATING ROTARY ENGINE COMPANY, of New York, has been incorporated; capital, $100,000. Directors: C. F. Jewett, A. M. Davidson, New York; Herman Neilson, South Brooklyn.

THE NIAGARA GARAGE COMPANY, of Niagara Falls, N. Y., has been incorporated to manufacture various kinds of motors. Capital, $5000. Incorporators: A. H. C. Hardwick, H. S. Mathews, W. L. Adams, all of Niagara Falls, N. Y.

THE MOLINE INCANDESCENT LAMP COMPANY has been incorporated at Moline, Ill., to manufacture electrical apparatus. The capital stock is $30,000, the incorporators being Albert H. Kreitler, Conrad F. Gratz, Sr., and Elmer E. Morgan.

PERSONAL.

MR. HOWARD S. KNOWLTON, of Boston, has recently joined the engineering department of the Colorado Telephone Company, and is now stationed at the Denver headquarters.

MR. CHARLES BRIGHT, F. R. S. E., so well-known in connection with his writings on the history of the submarine cable, is writing the story again in popular form for the British publishing house of Sir George Newnes.

MR. D. MAZENET, of Mexico City, managing director of the Mexican General Electric Company, which concern represents the interests of the General Electric Company in Mexico, left this week for home after some six weeks' sojourn in the States.

MR. ROBERT McF. DOBLE, the consulting engineer, has returned to San Francisco after an absence of several months in Mexico, having completed the installation of the hydro-electric power plant and transmission of the Guanajuato Power and Electric Company.

MR. CALVIN W. RICE, consulting electrical engineer with the General Electric Company, delivered an address recently on electrical development before the New England Loft Dried Paper Manufacturers' Association at their banquet at the Nyassett Club, Springfield, Mass.

MR. J. K. ROBINSON, of Iquique, Chili, who represents the Westinghouse and other prominent American manufacturing interests in Chili, Peru, Bolivia and Ecuador, will leave for home Dec. 1. He is at present at the offices of the William E. Peck Company, 116 Broad Street, New York.

MR. E. B. ELLICOTT.—A telegram from Chicago advises us that the city electrician of Chicago, Mr. Edward B. Ellicott, has been appointed chief electrical and mechanical engineer of the St. Louis Exposition and has been granted leave of absence by Mayor Harrison from December 1 to May 1.

PROF. C. P. MATTHEWS, of Purdue University, is on leave for treatment of his eyes which appear to have been seriously affected. He has, however, associated himself temporarily with the Lamp Testing Bureau in New York City, taking up duties that will not tax his sight. His friends hope for early and complete recovery.

MR. E. O. CAROLAN, manager of the London offices of the General Electric Company and director of the British Thomson-Houston Company, Limited, is now on a visit to this side. At present he is on the Pacific Coast, whence he will go to Mexico for the purpose of gaining an insight into the principal electrical projects in the Southern Republic.

MR. C. F. CUTLER.—Charles F. Cutler has been elected a director and president of the Hudson River Telephone Company, James H. Manning, of Albany, who has filled the office of president for a number of years, retiring. Mr. Cutler is president of the New York Telephone Company, the New York & New Jersey Telephone Company, and the New York & Pennsylvania Telephone Company.

MR. HENRY L. SHIPPY, New York manager of the John A. Roebling's Sons Company, has been seriously ill with appendicitis, but we are glad to state is now recovering rapidly, without the necessity of an operation. This news of convalescence is most cheering to a host of friends and will, we know, be hailed with pleasure not only under the snowy peak of Fujiyama but on the streets of Johannesburg—wherever this popular prince of good fellows has wandered as a globe trotter.

MR. A. FREDERICK COLLINS has obtained permission from the Navy Department to install experimental apparatus for wireless telephony on the battleships *Kearsarge* and *Alabama*. These two vessels are now moored about one hundred and fifty yards apart at the Brooklyn Navy Yard. Mr. Collins will erect telephone booths on each ship. He will work under the supervision of Lieutenant Hudgins, of the *Kearsarge*. Wireless telegraphy has been the subject of several experiments in the Navy Department, and several vessels are equipped with the apparatus, but wireless telephony has not been tried in any navy in the world. If the results are satisfactory, the West Indian squadron will make further trials this winter in Caribbean waters.

MR. J. D. CRARY has been elected president of the American Trade Press Association, which has a membership of more than 100 of the largest trade and technical publications of America. He succeeds Mr. J. M. Wakeman, of the ELECTRICAL WORLD AND ENGINEER. Mr. Crary is the founder, owner, and managing director of *The New York Lumber Trade Journal*, and the founder of the New York Lumber Trade Association. Mr. Crary has been secretary of that association since its start, eighteen years ago. He is also connected with the Association of Dealers in Masons' Building Materials. He is a Director and Chairman of the Membership Committee of the Apollo Club of Brooklyn, and a member of Montauk Lodge No. 286, F. & A. M.

MR. B. F. WASSON, of Clinton, Ill., the president of the Farm & City Telephone Company, which is one of the largest independent telephone companies in the State of Illinois, has been assigned the position of making a display of the evolution of the independent telephone in the Electricity Building at the World's Fair at St. Louis. He has already quite a collection of the different parts of some of the old telephones, but asks his telephone friends to help him out in this undertaking, by sending a telephone or any part of a telephone that is not commonly found, to be placed in this collection. Everything that is entrusted in Mr. Wasson's care will be taken care of, and when put on exhibition will have the name of the loaner, when patented, and manufactured by whom. When the Exposition is over the articles will be returned if requested without any expense.

MR. ORRIN E. DUNLAP, the well-known writer on Niagara topics, has a very interesting article in the December *Booklovers' Magazine* on "The Frost King of Niagara." He figures out that the "ice bridge" there would support a 20-story skyscraper and as to the Falls running dry, says: "On the 29th of March, 1848, Niagara ran dry as a result of a great ice jam at the entrance to the river near Buffalo. At that time the ice swept down the lake in such quantities that a jam of unusual proportions was created at the entrance to the river. So effective was the ice jam that no water passed around it. After the falls had drained the river channel the spectacle of the falls running dry was developed. There were many remarkable sights, and residents of the locality ventured to places that they had never expected to reach. Horses were driven far out in the river bed, and the most distant points in midstream knew the sound of footsteps. Millers, when called in the morning, were amazed at the information that there was no water in the river. People left Table Rock, on the Canadian side, and walked along the brink of the Horseshoe fall one-third of the way over to Goat Island. On March 22, 1903, a similar condition existed."

LEGAL.

TOLEDO TELEPHONE RATES.—Suit has been filed in the Ohio Supreme Court to test the question of the right of the Toledo Home Telephone Company to charge a rate in excess of the amount fixed in its franchise.

TELEPHONE SUBWAY FRANCHISE.—The application of the Independent Telephone Company, of New York, to run its wires in the subway of the Rapid Transit Railroad has been denied by the New York supreme court. Reference was made to this application in our issue of Nov. 14 last.

PAYMENT OF EXCESS FARE.—At Hudson, N. Y., on November 18, City Court Judge Tilden decided in favor of the Albany & Hudson Railroad a case which rose from the refusal of two men to pay 5 cents excess demanded of them. When the men persisted in their position the conductor ran the car back to Police Headquarters and had them arrested for violating a city ordinance. The question now decided in the affirmative was whether the company could sell tickets at 10 cents in the office and charge 15 to those who paid on the train, even if the office were not open at all hours during the running of trains. Judge Tilden decided that a refusal to pay fare under these circumstances constituted disorderly conduct within the meaning of the city ordinance.

SUBWAY COMPANY SUED.—Corporation Counsel of New York City has brought suit, by direction of the Mayor, against the Consolidated Electrical Subway Company. The complaint says that the annual statements of the company to the Comptroller were "false, fraudulent, untrue and made in bad faith," and that its net annual profits have for a long time exceeded 10 per cent on the actual cash invested, one-third of which surplus, under its contract, should have gone to the city and has not been paid. The city demands an accounting and that it be decreed that the company has failed to observe the terms of its contract in such a way as to bring into operation another clause of the contract, under which, upon such failure the city may take possession of the subways on certain specified terms.

FRANCHISES CANNOT BE UNREASONABLE.—The supreme court of Wisconsin has just handed down a decision which virtually determines the extent to which communities can go in granting public service franchises. The Northwestern Heat, Light & Power Company obtained a franchise from the village board of West Allis, Wis., authorizing it to furnish lights for fifty years at $120 per lamp per year. The franchise was submitted to a vote of the people and ratified. Notwithstanding that certain citizens brought action to set it aside on the ground that it was unreasonable, both as to the time the franchise ran and the cost of the lights. Expert testimony was taken as to the cost of producing lights and the probable cost in the future. Judge Tarrant in the lower court decided the point in favor of the company because the people had voted in favor of the franchise, and held that it was not sufficiently unreasonable to warrant the court in overriding the expressed wishes of the people most interested. The supreme court, however, decided that it was so unreasonable that it could not stand and reversed the decision of the lower court.

CONTRACTS BY TELEPHONE.—When J. W. Young went to the Klondike, in 1898, he left instructions with a friend to have a trunk stored with the Seattle Transfer Company. This friend, a Mr. Ramsey, accordingly called up the company by telephone and asked them to call for the trunk. A second request was made before the trunk was taken away. Mr. Ramsey did not recognize the voice answering him at the telephone and had no means of proving that a Seattle Transfer Company agent got the trunk, save that some one, whom he did not see, called for it. In the Summer of 1891 Mr. Young wrote down from Alaska to Mr. Ramsey to have the trunk forwarded to him. The Seattle Transfer Company was unable to find the property in its warehouse and denied ever having received it. A suit followed and on the strength of the telephone conversation a jury gave Mr. Young $240 damages. The Supreme Court of the State of Washington, in ordering a reversal, holds that "communications, when material to the issues, through the medium of the telephone, may be shown in the same manner and with like effect as conversation had between individuals face to face, but the identity of the party sought to be charged with liability must be established by some testimony either direct or circumstantial. To hold parties responsible for answers made by unidentified persons in response to calls at the telephone from their offices or places of business concerning their affairs opens the door for fraud and imposition and establishes a dangerous precedent which is not sanctioned by any rule of law or principle of ethics of which we are aware."

Trade Notes.

CROCKER WHEELER COMPANY, Ampere, N. J., has established headquarters for the Southern representative of its Washington office, Mr. S. M. Conant, at 425 Empire Building, Atlanta, Ga.

AMERICAN REFLECTOR & LIGHTING COMPANY, Chicago, has been compelled by increase of business to take larger quarters and is now located at 199 to 205 Van Buren Street and 275 Franklin Street, that city.

F. BISSELL COMPANY, wholesale electrical supplies and machinery, Toledo, Ohio, has just issued a bulletin, No. 6, showing some 61 different kinds of wires, strands and cables. It can be had on application. It represents a great deal of trouble and expense and is very interesting.

ZENITH LAMPS.—The heavy demand for Zenith lamps swamped the manufacturers and delays were the consequence. The Electric Appliance Company of Chicago, general sales agent, now reports a big stock, and states that the large increase in the factory output will mean no more delays in filling orders for this specialty.

AUTOMATIC ELECTRIC COMPANY, of Chicago, has issued a "bulletin de luxe" containing letters received from subscribers to the big automatic telephone exchange built by the company for the Dayton, Ohio, Home Telephone Company. It contains also letters from the management, and other matter, constituting a record of great interest as to results in the automatic field.

THE REYNOLDS ELECTRIC FLASHER MFG. COMPANY has recently made changes and additions to its shop which will enable it to meet the increasing market for sign flashers and to fill orders more promptly than heretofore. The demand during the past fall has been so large that the company has had difficulty in keeping up with its orders; hence the need of increased facilities.

THE STERLING ELECTRICAL MFG. COMPANY has brought out a pocket tape measure enclosed in a neat celluloid case on which is inscribed the name of the company and an illustration of the Sterling special incandescent lamp. The latter shows the illumination of the lamp as being 16-cp from all light-giving points of the bulb. The New York office of the company is in charge of Mr. Francis Granger, at 26 Cortlandt St.

THE K. & B. COMPANY, 56 North 7th Street, Philadelphia, has recently been appointed local agent for Buckeye incandescent lamps. This company is also agent for the Electric Carriage Call Company's system and has effected several installations in Philadelphia. Among the other specialties in which the K. & B. Company is doing a good business are Hadaway electric heating apparatus and Norden-Bittner interchangeable letters for sign work.

MR. GEORGE H. MOSEMAN has been appointed selling agent for the Weston Electrical Instrument Company with offices at 176 Federal Street, Boston. This is a new departure, and Mr. Moseman is the first selling representative that company has had in this territory. Mr. Moseman was connected with the old United Edison Company and with the Edison General Electric Company for four years prior to the formation of the General Electric Company, with which he had a connection also of ten years' standing.

THE COLONIAL SIGN COMPANY, of Akron, Ohio, is the company making electric signs in which the letters are of white vitreous porcelain, as already described in ELECTRICAL WORLD AND ENGINEER. One of the latest orders it filled is a sign for the Hotel Rodman, Philadelphia, the owner of which is the Hon. John Wanamaker. The order was secured not only because of the beauty of the sign letter and its legibility both day and night, but because of the safety of construction, including the impossibility of short circuit and other electrical faults.

FREIGHT ON NEW YORK CENTRAL.—New York Central officials have made public the running time of a freight train loaded with export cotton, which is was said holds the freight record between Montreal and New York. The train made the 435 miles between Valleyfield, Quebec and New York in 16 hours and 20 minutes. Two hundred bales of Egyptian cotton were in store at Valleyfield, a few miles south of Montreal. They had been sold to Liverpool spinners and in order to make delivery it was necessary to get the cotton to New York within seventeen hours.

THE CENTRAL ELECTRIC COMPANY, Chicago, Ill., has issued a circular calling attention to its line of electric fixtures. One room of its establishment has been especially fitted up for the purpose of its fixture display. It is tastily decorated and the display itself while not large is of an exceedingly attractive nature. The fixtures shown are varied, including almost everything of electrical or combination nature, also glassware and trimmings. The display is a convincing proof that the company is in the fixture business to stay and is prepared to take care of that class of trade.

ELECTRICAL DATA.—The Chase-Shawmut Company, Newburyport, Mass., has just issued the 1904 edition of its pamphlet containing electrical data. There is a great deal of information in the pamphlet in the way of rules, formulas, wire and other tables, all of which are constantly being referred to by engineers. Switchboards are also given prominent attention, and many illustrations show how they are constructed and connected. Various illustrations show completed switchboards manufactured by the Chase-Shawmut Company. Other products of the company, including fuses, conduit boxes, rail bonds, etc., are represented.

LAMP TESTING BUREAU.—The equipment of the new electrical testing laboratories of the Lamp Testing Bureau at 80th Street and East End Avenue, New York, is planned to be as complete and up-to-date as a wise and liberal management can make it. Nothing better indicates the broad policy of the company than the fact of its having recently sent its test officer, Dr. Clayton H. Sharp, to inspect all of the principal electrical laboratories of Europe, so that on his return he may be better able to equip the new laboratories to meet the needs of those who require its services. During Dr. Sharpe's absence the company has secured the services of Dr. C. P. Matthews, late of Purdue University, to advise concerning the photometric equipment of the new laboratories.

ALLIS-CHALMERS ENGINES IN FOREIGN COUNTRIES.—The Allis-Chalmers Company has just issued a 78-page booklet containing a list of foreign users of engines built by it. This record shows that of a large number of Allis-Chalmers engines are used in almost every country on the face of the earth, and is strong evidence of the high regard with which this make of engine is held throughout the world. Scattered through the pages of the pamphlet are illustrations representing the different types of machines produced by this company. In general the line includes engines for power purposes, pumping engines, hoisting engines, blowing engines and air compressors. Views of the company's various and thoroughly equipped plants are also presented. This list is particularly interesting as an evidence of the vitality of American industry and enterprise.

THE ELECTRIC CONTRACT COMPANY, 202-204 Centre Street, New York City, has just issued a very handsome catalogue, No. 4, with regard to its electrical novelties of all kinds, including particularly dry batteries, Williams' spark coils, Jaeger incandescent bulbs, and automobile supplies. The catalogue illustrates a number of portable lights combining dry battery and miniature incandescent lamps put up in flask and stick form, as well as in tapers, watchstands, scarf pins and other specialties. It includes also the company's electric gas lighter, medical set of Ecco apparatus, dental lamps, testing sets and other varieties of that character. A special section of the catalogue is devoted to the Williams spark coils, which are put up in very handy and compact form, and arranged in multiple for special automobile purposes. A separate section of the catalogue is also devoted to the Jaeger miniature incandescent lamps, which have long been before the public, and which enjoy an excellent reputation. These are profusely illustrated with prices and descriptive data. A page is devoted to the Phoenix handy receptacle for trimming Christmas trees and general decorative work. This receptacle is fitted with two triple insulated leading wires and provided with a sharp pointed screw thoroughly insulated by mica washers and which sticks easily into either hard or soft wood.

Record of Electrical Patents.

UNITED STATES PATENTS ISSUED NOVEMBER 17, 1903.

[Conducted by Wm. A. Rosenbaum, Patent Attorney, 140 Nassau St., N. Y.]

744,018. METHOD OF FORMING COILS FOR ELECTRICAL APPARATUS; Edward L. Aiken, Schenectady, N. Y. App. filed Dec. 5, 1898. A coil made by bending a relatively wide and thin strip of conducting material edgewise into a helix without reduction of cross-sectional area.

744,041. TELEGRAPHIC CODE; Charles G. Burke, Brooklyn, N. Y. App. filed Sept. 21, 1901. In this code each character consists of two parts, each composed of one or more dots and each part having a numerical signification, both parts construed as a whole indicating a definite position on a chart or scale to which has been assigned a letter of character.

744,046. ELECTRIC PRINTING TELEGRAPH APPARATUS; Henry Casevitz, Paris, France. App. filed March 14, 1903. Details.

744,051. TIME LIMIT DEVICE FOR MOTOR CONTROLLERS; Fred B. Corey, Schenectady, N. Y. App. filed May 24, 1902. The device comprises a dash pot and a step member constructed to prevent a too rapid movement of the controller while allowing a free movement from one contact point to the next.

744,053. DEVICE FOR ALTERNATING CURRENT MOTOR CONTROL; Joseph Le C. Davis, Schenectady, N. Y. App. filed July 22, 1903. Two alternating current motors, the winding of one member of each being supplied with a commutator, a closed circuit including said winding and means for producing in said circuit a current varying simultaneously in magnitude and phase.

744,055. ELECTRIC RAILWAY SYSTEM; William Embley and Abraham A. Shobe, Jerseyville, Ill. App. filed April 10, 1903. The conductor is mounted in hangers which are free to slide in their supports to accommodate the expansion and contraction of the conductor.

744,077. COMMUTATOR; Charles H. Ingalls, Danvers, Mass. App. filed Oct. 3, 1901. (See page 879.)

744,084. DYNAMO-ELECTRIC MACHINE; George Macloskie, Schenectady, N. Y. App. filed July 19, 1902. (See Current News and Notes.)

744,093. ELECTRIC ARC LAMP; James McLaughlin, New York, N. Y. App. filed July 26, 1902. Clutch dogs are pivoted at the lower end of the tubular core of the solenoid and project into the same, an adjustable device with which the lower ends of the dogs engage for opening them are placed at the limit of movement of the core.

744,096. OZONIZER; Marius Otto, Paris, France. App. filed May 29, 1903. (See page 879.)

744,103. TELEPHONE CUT-OUT; William Lee Ralston, Westchester, Ia. App. filed July 22, 1903. (See page 880.)

744,106. LIGHTNING ARRESTER; Henry E. Raymond, Schenectady, N. Y. App. filed July 22, 1899. (See Current News and Notes.)

744,115. QUICK BREAK SWITCH; Howard R. Sargent, Schenectady, N. Y. App. filed April 18, 1902. An auxiliary blade is hinged to the main blade and connected thereto by a spring which lifts it quickly out of the clips, the auxiliary blade having integral ears fitting the main blade and guiding it in its movement.

744,117. PRIVATE TELEPHONE SYSTEM; Thad. J. Seely and Charles Hemsing, Milwaukee, Wis. App. filed Oct. 23, 1901. (See page 880.)

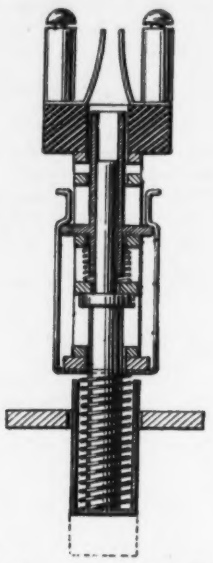
744,124. ELECTRIC METER; George Stern, Charlottenberg, Germany. App. filed July 9, 1901. An alternating current meter for a four-wire three-phase system, comprising two meter systems in one of which two current windings having equal numbers of turns are combined with a single potential winding and in the other of which two current windings having a ratio of turns of one to three are combined with a single potential winding.

744,125. CIRCUIT BREAKER; Samuel B. Stewart, Jr., Schenectady, N. Y. App. filed Jan. 23, 1901. Improvements in an overload switch for trolley cars.

744,130. ELECTRIC ARC LAMP; Elihu Thomson, Swampscott, Mass. App. filed May 21, 1901. An arc striking magnet in series with the arc, a derived circuit magnet tending to shorten the arc, a shunt circuit around the arc striking magnet and means for maintaining the shunt circuit open when the electrodes of the lamp are together and for closing it when the electrodes are about to feed together.

744,144. METHOD OF WINDING DYNAMO ELECTRIC MACHINES; John B. Wiard, Lynn, Mass. App. filed March 21, 1903. A winding consisting of an independently wound long coil woven in and out of the notches of the core in such a manner as to make a number of short coils connected in series.

744,145. WINDING FOR DYNAMO ELECTRIC MACHINES; John B. Wiard, Lynn, Mass. App. filed April 3, 1903. See preceding patent.



744,215.—Circuit Controller.

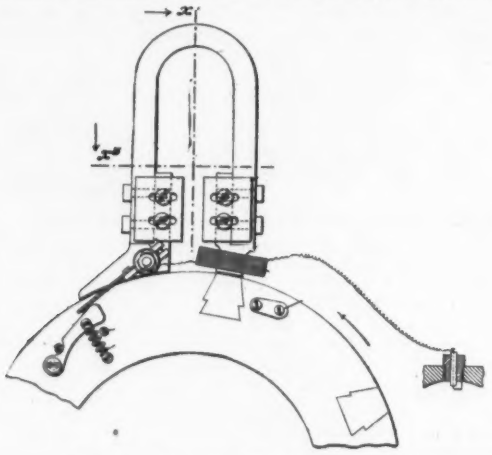
744,165. AUTOMATIC PRINTING TELEGRAPH SYSTEM; Louis Casper, Chicago, Ill. App. filed March 10, 1898. A transmitter tape having different series of perforations is fed or controlled by a motor synchronous in action to another motor operating the printing wheel of the receiver, the tape being used to send multiple signals or impulses which vary in polarity and current intensity.

744,168. AUTOMATIC SWITCH; Joseph M. Comer, Spokane, Wash. App. filed March 30, 1903. A magnet operating through a pawl and ratchet and levers to throw the switch point of a railway.

744,170. PROCESS OF DEPOSITING METALLIC COATINGS ON METALLIC OBJECTS; Andre Barlay, Paris, France. App. filed Aug. 26, 1899. (See page 897.)

744,171. METHOD OF SEPARATING OILY OR SIMILAR IMPURITIES FROM WATER; Henry Tadwell Davis and Ernest Perrett, Lewisham, England. App. filed Dec. 1, 1902. (See page 879.)

744,178. CONTROLLING DEVICE FOR MOTORS; Charles A. Dresser, Chicago, Ill. App. filed June 19, 1902. Two motors operated by a controlling device which itself is operated by the closing of a single circuit, the controller comprising a series of actuating parts successively brought



744,573.—Magneto Electric Generator.

into action to start one motor, to start a second motor and to slow down or stop the first motor.

744,187. SYSTEM OF ELECTRIC TRACTION; Lucius T. Gibbs, New York, N. Y. App. filed April 13, 1903. The vehicles carry dynamos and propelling motors and are also connected with a line wire so that excessive power generated will be delivered to the line for use by other vehicles.

744,197. THERMAL CIRCUIT-PROTECTOR; Otto C. Hoffmann, Chicago, Ill. App. filed Jan. 19, 1903. (See page 880.)

744,215. CIRCUIT CONTROLLER; Adam Lungen, New York, N. Y. App. filed Nov. 13, 1902. The circuit controller comprises two rods having motions independent of each other, a spring interposed between them which is compressed and expanded by the relative movements of the rods and a latch adapted to restrain one rod, but to be released by the tension of the spring.

744,216. ELECTRICAL STORAGE-CELL; John A. Lyons and Edward C. Broadwell, Chicago, Ill. App. filed Jan. 26, 1903. (See page 879.)

744,246. ELECTRIC RAILWAY SYSTEM; Abraham A. Shobe and William Embley, Jerseyville, Ill. App. filed April 10, 1903. A means for mounting the conductor in a manner permitting it to freely expand and contract without injury to its supports or insulation.

744,247. ELECTRIC RAILWAY SYSTEM; Abraham A. Shobe and William Embley, Jerseyville, Ill. App. filed April 10, 1903. The return current is carried by an insulated conductor mounted upon the traffic rail.

744,248. RAILWAY SIGNALING SYSTEM; Judson Shoecraft, Eskridge, Kan. App. filed Aug. 30, 1902. Details.

744,261. SYSTEM OF ELECTRIC LIGHTING FOR CARS; Charles P. Tolman, Boston, Mass. App. filed July 30, 1903. An arc and an incandescent lamp are located in the same headlight with automatic means for throwing the incandescent lamp into circuit in case the arc lamp fails.

744,303. ELECTRIC LOCOMOTIVE; William Dalton and Francis J. Cole, Schenectady, N. Y. App. filed July 20, 1903. (See Current News and Notes.)

744,304. ELECTRIC LOCOMOTIVE; William Dalton and Francis J. Cole, Schenectady, N. Y. App. filed Aug. 20, 1903. (See Current News and Notes.)

744,330. ELECTRIC LAMP SOCKET; John H. Goehst, Chicago, Ill. App. filed May 12, 1902. A receptacle adapted for signs and consisting of two parts, one being a nut threaded onto the other and arranged to clamp the face of the sign to hold the receptacle thereto.

744,336. ELECTRICAL RINGING OF BELLS FOR SUBMARINE SIGNALING; Elisha Gray, Highland Park, Ill. App. filed Dec. 24, 1900. (See Current News and Notes.)

744,337. MEANS FOR DISINFECTING TELEPHONE-TRANSMITTER MOUTHPIECES; Maurice Griffin, Sylvester Sanker and Boyd Keith, Riverside, Cal. App. filed May 18, 1903. (See page 880.)

744,354. ELECTRIC ALARM SIGNAL FOR RAILWAY CARS; David N. Jordan, East Providence, R. I. App. filed Jan. 29, 1903. The tread of the car step operates an alarm circuit closed by the weight of a passenger to inform the conductor if a person is entering the car or alighting therefrom.

744,362. IMPLEMENT FOR LAYING UNDERGROUND CONDUITS; Mathias Kondolf, Rochester, N. Y. App. filed Feb. 2, 1903. An expanding device to be inserted in the conduit to hold a section in alignment until it is permanently fixed.

744,423. ELECTRICAL CLUTCH AND BRAKE MECHANISM; Abram P. Steckel, Buffalo, N. Y. App. filed June 3, 1903. The clutches and brake are provided with electrical controlling means whereby either can be thrown into and out of action separately, the arrangement being such that the brake is energized and brought into action to retard the driven shaft after a clutch is de-energized and before another clutch can be brought into action to reverse the driven shaft.

744,446. TROLLEY GUIDE; Milton Walker, Cambridge, Mass. App. filed April 3, 1903. Beneath the trolley frog is a guide rail upon which a truck runs to properly guide the trolley wheel across the frog.

744,463. TROLLEY HEAD; Joseph Bishop, Westbrook, Me. App. filed March 26, 1903. A device to retain the wheel upon the wire.

744,481. MAGNET; Henry F. Campbell, Melrose, Mass. App. filed July 9, 1902. (See page 879.)

744,496. INCANDESCENT ELECTRIC LAMP; Clarence A. Crane, Warren, Ohio. App. filed May 18, 1903. (See Current News and Notes.)

744,497. TELEPHONE HYGIENIC APPLIANCE; Horace L. Cutter, Los Angeles, Cal. App. filed March 9, 1903. (See page 880.)

744,507. MIRROR DECORATING AND ILLUMINATING DEVICE; Sabella G. Doherty, New York, N. Y. App. filed June 12, 1902. An ornament hanging in front of a mirror is studded with lamps supplied through conductors hidden behind the ornament itself.

744,530. PORTABLE ELECTRIC LIGHTING APPARATUS; Edwin R. Gill, New York, N. Y. App. filed April 7, 1902. Details.

744,573. MAGNETO ELECTRIC GENERATOR; Leon J. Le Pontois and Adolphe Clement, Levallois-Perret, France. App. filed Aug. 13, 1901. An igniting circuit which includes a coil about one of the pole pieces of the field magnet of the generator, a device for producing variations in the magnetic circuit and automatic devices influenced by centrifugal force for controlling a break in the igniting circuit.

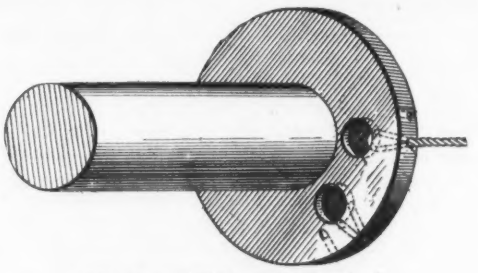
744,575. MINIATURE TELEGRAPHIC INSTRUMENT; Benjamin I. Levi, New York, N. Y. App. filed Dec. 26, 1902. A small sized key and sounder intended as a novelty or toy.

744,599. RAILWAY SIGNALING APPARATUS; James A. Norton, Odebolt, Ia. App. filed May 13, 1901. Details.

744,631. INSULATOR; Edward F. Schoenthaler, Long Branch, N. J. App. filed June 16, 1903. The insulator has a widened slot to receive the wire which is confined therein by a binding wire and a link closing the entrance to the slot.

744,650. ELECTRIC COIL TERMINAL; Richard Varley, Providence, R. I. App. filed Aug. 29, 1903. A terminal consisting of a U-shaped wire is anchored in the flange of a magnet spool by running its arms through two passages in the flange and twisting the projecting ends together.

744,655. COMBINED SIGNALING AND TELEPHONIC INTERCOM-



744,650.—Electric Coil Terminal.

MUNICATING SYSTEM FOR RAILROADS; John Alexander Whyte and Gordon Cameron Edwards, Toronto, Can. App. filed Jan. 24, 1903. See page 880.)

744,665. CONTROLLER; Thorsten von Zweigbergk, Preston, Eng. App. filed April 7, 1902. The combination of a pair of series wound motors connected together in series independently of the controller, the fields and armatures being thus on a closed local circuit and a controller adapted to convert the local circuit into a derived circuit from the source of current or to form a bridge across it for braking action.

744,680. ELECTRIC MOTOR; Rudolf Eickemeyer, Jr., and Mary T. Eickemeyer, Yonkers, N. Y. App. filed June 2, 1898. The invention comprises an armature core provided with two separate windings, each two coils in each winding having sides which reversely overlie each other and are located between similarly reversely overlaid sides of coils belonging to the other winding.